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Thesis

THE USES OF DECIMALS IN BUSINESS

Submitted by

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degree of Master of Education

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First Reader-Guy M. Wilson-Professor of Education
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THE UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

REPORT

ON THE CHEMISTRY OF THE

ATMOSPHERE

IN THE CITY OF CHICAGO

BY J. H. VAN VOSSEN, JR.

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I. INTRODUCTION

1. INTRODUCTION

THE PROBLEM

Up to the present time, many varied opinions have been held in regard to the significance which decimals enjoy in the elementary school arithmetic curricula. There are those in authority who maintain that decimals in all forms should be taught in the primary grades; on the other hand, we have arithmetic educators who advocate the postponement of teaching decimals in their more intricate forms, such as percentage and interest, until the higher grades are reached. Obviously, while opinions such as these continue to exist, we cannot hope to attain a standard arithmetic curriculum, at any rate, as far as decimals are concerned. The gap between the two extremes is a tremendous one; consequently, we cannot be too severe in our criticisms of the thousands of school administrators whose constructed arithmetic curricula vary in content and order of presentation as do our present theories of arithmetic education.

In order that the significance of the last statement may be more fully realized by the reader, allow me to illustrate what I think to be a typical example of what we may expect to find in the majority of our public schools today. In 1926, the Committee of Seven of the Superintendent's and Principal's Association of Northern Illinois made a survey of the current arithmetic practices of one hundred twenty-five school systems in the middle west.¹ Among other things, the committee sought to find out: (1) what topics were included in the various arithmetic curricula, and, (2) in what grades were these topics

¹
Washburne, Carleton W., "When Should We Teach Arithmetic"
pp. 659-665.

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introduced and completed. In regard to decimals the following was found:

In one school system addition and subtraction of decimals were introduced in the second grade; two school systems introduced this topic in the third grade; six, in the fourth grade; fifty-four in the fifth grade; and sixty-one in the sixth grade. One school system completed this topic in the fourth grade; five completed it in the fifth grade; seventy-seven in the sixth grade; twenty, in the seventh grade; and six, in the eighth grade.

The topic of multiplication of decimals was introduced by one school system in the third grade; by four systems in the fourth grade; by forty-eight in the fifth grade; and by seventy-one in the sixth grade. Two school systems completed this topic in the fifth grade; seventy-six completed it in the sixth grade; twenty-three, in the seventh grade; and seven in the eighth grade.

Three school systems were found to have introduced the topic of division of decimals in the fourth grade; forty-two introduced it in the fifth grade; seventy-seven in the sixth grade; and two in the seventh grade. This topic was completed by one school system in the fifth grade; by seventy-four systems in the sixth grade; by twenty-two, in the seventh grade; and by twelve in the eighth grade.

Table I, on the following page summarizes these findings.

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Table I, on the following page summarizes these findings.

Table I. Grades in Which Topics in Decimals Are Introduced And Completed In 125 School Systems

Topic	Grades In Which Topic Is Introduced						Grades In Which Topic Is Completed				
	2	3	4	5	6	7	4	5	6	7	8
Addition & Subtraction of Decimals	1	2	6	54	61		1	5	77	20	6
Multiplication of Decimals		1	4	48	71			2	76	23	7
Division of Decimals			3	42	77	2		1	74	22	12

(From: Table I - "Elementary School Journal", May, 1928
Number 9, page 661)

Table I. Grades in Which Topics in Decimals are Introduced and Completed in 123 School Systems

Topic	Grades in Which Topic is Introduced					Grades in Which Topic is Completed				
	1	2	3	4	5	6	7	8	9	10
Division of Decimals			1	2	3	4	5	6	7	8
Multiplication of Decimals			1	2	3	4	5	6	7	8
Addition & Subtraction of Decimals			1	2	3	4	5	6	7	8

(From: Table I - "Elementary School Journal", May, 1923)
 Number 2, page 661

These statistics indicate very clearly the lack of uniformity and agreement of elements and procedures pertaining to decimals and their usage. It seems logical to assume that the topic of decimals should be introduced at a certain grade level, but the illustrated facts are in utter disagreement with such an assumption.

Wilson, in 1911, stated that --"the chief purpose of arithmetic in the course of study is its utility in the common affairs of life."¹ I fully agree with the quotation. Inasmuch as my problem deals with the usage of decimals, may I express my own opinion in terms synonymous to those of Doctor Wilson by specifically stating that the teaching of decimals in the grades is justified only on the basis of their utility in the common affairs of life. And the common affairs of life are closely associated with the different types of business and professions.

In light of the facts presented, then, what are the usages of decimals; where should they be introduced in the curriculum; to what extent should they be taught? Keeping in mind that the teaching of decimals should be in direct harmony with their practical value in life situations, the writer will attempt to show the usages of decimals as they occur in business today.

¹Wilson, Guy M., "Connersville Course of Study in Mathematics."
p.11.

These statistics indicate very clearly the lack of uniformity and agreement of elements and procedures pertaining to decisions and their usage. It seems logical to assume that the topic of decisions should be introduced at a certain grade level, but the illustrated facts are in total disagreement with such an assumption.

Wilson, in 1911, stated that -- "The chief purpose of arithmetic in the course of study is its utility in the common affairs of life." I fully agree with the position. However, as my problem deals with the usage of decisions, may I express my own opinion in terms synonymous to those of Foster which by essentially stating that the teaching of decisions in the grades is justified only on the basis of their utility in the common affairs of life. And the common affairs of life are closely associated with the different types of business and professions.

In light of the facts presented, then, what are the usages of decisions; where should they be introduced in the curriculum; to what extent should they be taught? Keeping in mind that the teaching of decisions should be in direct harmony with their practical value in life situations, the writer will attempt to show the usages of decisions as they occur in business today.

THE PROCEDURE

This thesis represents an earnest effort to provide accurate data concerning the actual usus of decimals as they exist in the business world today. Much practical material has necessarily been introduced for tying-up purposes, but decimal facts have, nevertheless, received the main emphasis. Undoubtedly, the results of such a research, carried on chiefly through methods of interview and observation, are of value in determining what, of decimals, should be taught in our schools.

In carrying out my investigations I have endeavored to be as systematic as possible. Below, my procedure is listed briefly:

- (1) To record the total number of employees in each type of business investigated.

- (2) To subdivide the total number of employees into homogeneous groups, departments or sections.

- (3) To find out in each group just what amount of knowledge of decimals each member must possess in performance of his or her duties.

- (4) To discover the purposes for calculations on the part of those needing a computative knowledge.

- (5) To show the proportions of the various types of decimal knowledges needed by the employees in each type of business to the total number of employees.

- (6) To deduce conclusions in each investigated study.

THE PROGRAM

This thesis represents an earnest effort to provide accurate data concerning the actual usage of decimals as they exist in the business world today. Such practical material has necessarily been introduced for typing purposes, but decimal facts have, nevertheless, received the main emphasis. Undoubtedly, the results of such a research, carried on chiefly through methods of interview and observation, are of value in determining what, of decimals, should be taught in our schools.

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- (5) To show the proportions of the various types of decimal knowledge needed by the employees in each type of business to the total number of employees.
- (6) To deduce conclusions in each investigated study.

In presenting these findings, I readily admit and very well realize that all types of businesses were not and could not be investigated. However, in justice to myself, let me say that I have tried to use unprejudiced judgment in my selections, and in my honest opinion, the types of businesses studied are an adequate representative sampling of the entire field of business.

It is, perhaps, needless to point out that the chief contribution to which this thesis can lay claim is in the revelation of actual decimals which are now being used in business. Such a disclosure, I believe, will afford suggestions in the matter of choice and arrangement of decimals for classroom presentation. It seems to me that a sane and sober presentation of decimals and decimal problems which conform to life situations will do much toward standardizing the teaching of this topic.

My personal thanks are due to Doctor Guy M. Wilson, Professor of Education at Boston University, for many helpful suggestions with respect to presentation of material, and for advice and criticism which he gave me at various stages in the preparation of this thesis. Acknowledgements are gratefully given to Mr. Reginald C. Downes, of Chandler & Company; to Doctor John Shadman and Mrs. B. O'Leary, of the Forest Hills Hospital; to Mr. William C. Todd, of the Otis Elevator Company; to Messrs. W.J. Corbett and T.P. Keefe of the Devonshire

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X

Financial Service Corporation; to Messrs. D.M.Ferguson and C.D.Hurd of the Burroughs Adding Machine Company; to Messrs. J.A.Galvin and H.R.Chandler, and to Miss Mary E. Davies of the United Drug, Incorporated; and to Messrs. J.J.Riordan and W.C.Gleason, of the Whiting Milk Companies. Without the co-operation of these persons this study could not have been carried on successfully.

Joseph E. Buckley

11. RESEARCH SPENDING IN THE FIELD

Financial Service Corporation; to Messrs. D.M. Ferguson and
C.C. Ford of the Burroughs Adding Machine Company; to Messrs.
J.A. Galt and H.R. Chandler, and to Miss Mary E. Davis of the
United Drug, Incorporated; and to Messrs. J.T. Hixson and
W.C. Gleason, of the Whiting Milk Companies. Without the co-
operation of these persons this study could not have been
carried on successfully.

Joseph A. Buckley

II. PREVIOUS STUDIES IN THE FIELD

Many previous studies have been made in the arithmetic field. Such investigations as made by Buckingham, Buswell, Charter, Hinman, Judd, Munroe, Myers, Osburn, Strayer, Thorn-dyke, Wise and Woody must be acknowledged by the writer, and due credit is extended to these persons.

The studies which appear below are considered by the author to be the most important insofar as decimal usage was considered. For instance one study, involving a pupil survey method of determining basic facts for the curriculum in arithmetic was carried out in twenty-three different cities by Doctor Guy M. Wilson, in 1916.¹ Some rural sections were also included. This study involved 4068 people distributed among 155 occupations. A total of 14,583 problems was gathered that employed 21,898 processes. Wilson found that "in the entire study there were only seven problems involving decimals. Four of these involved buying gasoline at so many cents and the decimal of a cent (e.g. - 19.9) as was common in 1916. Of the other three decimals, one referred to the distance traveled by a drill press per revolution (.008 inches), and the other two were puzzle queries!"² As a conclusion Doctor Wilson adds, that because these problems "occurred so few times that it seems unreasonable to ask grade children to spend time in mastering them."³

In 1925, the same investigator conducted a school pupil survey in the Boston area.⁴ There were 5,463 problems collected, and of this total only 112 decimals occurred. There was one occurrence of a one place decimal, which represents .89%; ninety-eight

¹ Wilson, Guy M., "What Arithmetic Shall We Teach." p. 10.

²Ibid. p. 10 ³Ibid. p.10 ⁴Ibid. p.72.

Many previous studies have been made in the arithmetic field. Such investigations as made by Buckingham, Brewster, Charter, Minner, and others, however, have not been extended to these persons.

The studies which appear below are considered by the author to be the most important insofar as decimal usage was considered for instance one study, involving a pupil survey method of determining basic facts for the curriculum in arithmetic was carried out in twenty-three different cities by Doctor Guy M. Wilson, in 1916. Some rural sections were also included. This study involved 4000 people distributed among 155 occupations. A total of 14,588 problems was gathered that employed 21,888 processes. Wilson found that "in the entire study there were only seven problems involving decimals. Four of these involved buying gasoline at so many cents and the decimal of a cent (e.g. - 19.9) as was common in 1916. Of the other three decimals, one referred to the distance traveled by a drill press per revolution (.008 inches), and the other two were quite unrelated to a conclusion Doctor Wilson adds, that because these problems occurred so few times that it seems unnecessary to ask grade children to spend time in mastering them."

In 1925, the same investigator conducted a school pupil survey in the Boston area. There were 2,488 problems collected, and of this total only 112 decimals occurred. There was one occurrence of a one place decimal, which represented .82; ninety-eight

two place decimals were noted, which represents a percentage of 87.40; in nine instances, or 8.03 %, three place decimals occurred; and the frequency of occurrence of four place decimals was four, representing 3.57%. Highly vocational figuring accounted for the decimals of this study.

Wilson, as a result of his studies concludes the following computational needs, as relating to decimals:¹

Main Drill:

As money from the beginning; the point to separate dollars and cents; all processes.

Tax rates

Baseball scores

Reading decimals, three place or four place.

Simple work in addition, subtraction, multiplication of decimals, and dividing simple decimals by whole numbers.

(Preferably all this confined to U.S. money)

Some Drill:

Extension well within class comprehension; changing a common fraction to a decimal.

¹Ibid. p.125.

two place decimals were noted, which represents a percentage of 87.50; in nine instances, or 8.33, three place decimals occurred; and the frequency of occurrence of four place decimals was four, representing 5.56. Highly vocational training was counted for the decimals of this study.

Wilson, as a result of his studies, concludes the following computational needs, as relating to decimals:

Main Title:

is money from the beginning; the point to separate dollars and cents; all processes.

tax rates

Baseball scores

Reading decimals, three place or four place.

Simple work in addition, subtraction, multiplication of decimals, and dividing single decimals by whole numbers.

(Presumably all this confined to U.S. money)

Some Title:

Extension well within class comprehension; changing a common fraction to a decimal.

1

Another study was made by Mitchell, to determine the uses and needs for arithmetic. His data were collected from four sources namely, a standard cook book, the payrolls of a number of artificial flower and feather factories, marked-down sales advertisements, and a general hardware catalog. In his conclusions he makes this statement in regard to decimals: "Although decimalization is one of the distinguished features of present-day arithmetic, tenths and hundreths play but an insignificant part as units of production and of trade in commodities."

2

Varney, in conducting a pupil arithmetic survey in the town of Stoneham, Massachusetts, asked the parents of pupils in the fifth, sixth, and seventh grades of the Stoneham public schools to co-operate in the survey by allowing their children to report on any figuring which was done by the parents over a two weeks period. After a careful study of the problems submitted by the parents, the following facts relating to decimals were determined:

1. All decimals used were in United States money and in only two cases (the buying of gas) were more than the usual two places for cents found.

2. There were only seven problems which involved percentage. Five were agents' commissions, one was a discount allowed on a bill, and was concerned with interest.

¹Mitchell, H. Edwin, "Some Social Demands On The Course Of Study In Arithmetic." pp.7-17.

²Varney, Charles E "Improving ELEM. Arithmetic Teaching" pp.12-13

Another study was made by Mitchell, to determine the uses and needs for arithmetic. His data were collected from four sources namely, a standard text book, the payrolls of a number of artificial flower and leather factories, marked-down sales advertisements, and a general hardware catalog. In his conclusions he makes this statement in regard to decimals: "Although decimalization is one of the distinguished features of present-day arithmetic, tables and numbers play but an insignificant part as units of production and of trade in commodities."

Varney, in conducting a pupil arithmetic survey in the town of Stoughton, Massachusetts, asked the parents of pupils in the fifth, sixth, and seventh grades of the Stoughton public schools to co-operate in the survey by allowing their children to report on any figuring which was done by the parents over a two week period. After a careful study of the problems submitted by the parents, the following facts relating to decimals were determined:

- I. All decimals used were in United States money and in only two cases (the buying of gas) were more than the usual two places for cents found.
- II. There were only seven problems which involved percentages. Five were agents' commissions, one was a discount allowed on a bill, and was concerned with interest.

One of the most recent studies of decimals was carried on by Dalrymple. As a result of her investigation of decimal usages in industries, periodicals and textbooks she made the following conclusions:¹

1. Industries

A large percent of the employees in industry have no need of any knowledge of decimals. A small proportion which are those who do highly technical work need expert knowledge of decimals.

2. Statistics

The complication of statistics is a highly technical activity requiring expert use of difficult decimals. The reader needs only a reading knowledge.

3. Periodicals

Technical periodicals make use of a skillful knowledge of decimals not found in periodicals classified as non-technical, but reading only is required.

4. Newspapers

The decimals found in newspapers are almost exclusively in statistics made by experts; others merely read them.

5. Advertisement Pamphlets

Exceedingly few decimals, and those very simple were found in advertisement pamphlets of commodities.

¹Dalrymple, Marion E., "Study of the Present Use of Decimals in Industries, Periodicals and Textbooks." p.72.

One of the most recent studies of booklets was carried on by Delpy. As a result of her investigation of booklets in libraries, periodicals and textbooks she made the following conclusions:

1. Industries

A large percent of the employees in industry have no need of any knowledge of booklets. A small proportion which are those who do highly technical work need expert knowledge of booklets.

2. Statistics

The compilation of statistics is a highly technical activity requiring expert use of booklet booklets. The reader needs only a reading knowledge.

3. Periodicals

Technical periodicals make use of a skilled knowledge of booklets not found in periodicals classified as non-technical, but reading only is required.

4. Newspapers

The booklets found in newspapers are almost exclusively in statistics made by experts; others merely read them.

5. Advertisement Pamphlets

Exceedingly few booklets, and those very simple were found in advertisement pamphlets of common titles.

6. Textbooks

Textbooks in arithmetic contain a use of decimals far surpassing that needed in actual life situations of other than highly specialized adults.

Table II on the following page summarizes the data collected by Miss Dalrymple in reference to her study of decimals in industries:²

II. Table Showing the Use of Decimals in the American Refining Company and the Gillette Safety Razor Company.

The number of employees who:	American Refining Co.	Gillette Safety Razor Co.	Total	Percent of Total
Have no need of decimals	300	400	700	20
Only read decimals	100	25	125	31
Figure in decimals	45	70	115	9
Total	445	700	1145	100

²Ibid; p. 18.

Textbooks in arithmetic contain a use of decimals far surpassing that needed in actual life situations of other than highly specialized adults.

Table II on the following page summarizes the data collected by Miss Dalgryle in reference to her study of decimals in industries:

II. Table showing the usage of Decimals in the American Paper Refining Company and the Gillette Safety Razor Company.

Have no need of Decimals	The number of employees who:	American Paper Refining Co.	Gillette Safety Razor Co.	Totals of Totals	Percent
Only read Decimals		350	603	953	80
Figure in Decimals		105	25	130	11
		45	70	115	9
Totals		500	703	1203	100

Table II is read as follows:¹

Of those twelve hundred employees of both industries, 350 of the American Sugar Refining Company and 605 of the Gillette Safety Razor Company, making 955, or 80% have no need whatever of using decimals in anyway; 105 of the American Sugar Refining Company and 25 of the Gillette Safety Razor Company, making 130, or 11% require only a reading knowledge of decimals; and 45 of the American Sugar Refining Company and 70 of the Gillette Safety Razor Company, making only 115, or 9% do any figuring in decimals.

The foregoing field studies are such as to determine what should be taught in decimals. A study of a very different character was carried on by Brueckner.² It was a study of the confusion of children over the usual text book types of work in decimals. Brueckner sought: (1) to determine the types of examples found to be most difficult in each decimal process, and, (2) to discover the causes of the errors made. He studied the written work of more than three hundred pupils of grades six, seven, and eight in four different schools in Minneapolis. In addition, analytical diagnostic tests were given to the pupils, involving the four processes in decimals. In the summary of this investigation, Brueckner concludes that:³

(1) Many pupils do not have adequate concepts of the numerical values of decimals.

¹Ibid; p. 18.

². Brueckner, Leo J., "Diagnostic and Remedial Teaching In Arithmetic." pp. 219-258. 3. I

³ Ibid; pp. 236-237.

Table II is read as follows:

Of those twelve named employees of both industries, 330 of the American Sugar Refining Company and 605 of the Allstate Safety Razor Company, making 935, or 80% have no need whatever of using needles in any way; 105 of the American Sugar Refining Company and 25 of the Allstate Safety Razor Company, making 130, or 11% possess only a reading knowledge of needles; and 45 of the American Sugar Refining Company and 70 of the Allstate Safety Razor Company, making only 115, or 9% do any fighting in needles.

The foregoing field studies are used as to determine what should be taught in needles. A study of a very different character was carried on by Greenwood. It was a study of the collection of children over the named text book types of work in needles. Greenwood sought: (1) to determine the types of examples found to be most difficult in each needle process, and (2) to discover the causes of the errors made. He studied the written work of more than three hundred pupils of grades six, seven, and eight in four different schools in Minneapolis. In addition, analytical diagnostic tests were given to the pupils, involving the four processes in needles. In the summary of this investigation, Greenwood concludes that: (1) many pupils do not have adequate concepts of the technical values of needles.

Table II is read as follows:
Of those twelve named employees of both industries, 330 of the American Sugar Refining Company and 605 of the Allstate Safety Razor Company, making 935, or 80% have no need whatever of using needles in any way; 105 of the American Sugar Refining Company and 25 of the Allstate Safety Razor Company, making 130, or 11% possess only a reading knowledge of needles; and 45 of the American Sugar Refining Company and 70 of the Allstate Safety Razor Company, making only 115, or 9% do any fighting in needles.

(2) Many errors were due to the misspelling of the decimal written in word form, for example, "hundreds" for "hundreths."

(3) Failure to place the decimal point correctly was the greatest cause of errors in addition, $.3$ plus $.5$ plus $.8$ equals $.16$ being the most common type.

(4) The number of errors in addition due to inaccuracy was about half as great as the number of errors due to the misplacement of the decimal point.

(5) The greatest difficulties in subtraction were in borrowing and in the placement of the decimal number in the subtrahend. There were few errors due to inaccuracy.

(6) The major difficulty in multiplication of decimals was the misplacing of the decimal point or its complete omission.

(7) There were many errors due to inaccuracy in multiplication.

(8) The major causes of errors in division were the misplacing of the decimal point, faulty placement of zeros, omission of the decimal point, and inaccuracy.

The following types of examples were found by Brueckner in his investigation to present the greatest amount of difficulty to the pupils in each of the four processes of decimals:¹

¹Ibid; p. 237.

(2) Many errors were due to the misplacement of the decimal written in word form, for example, "thirty-two" for "thirty-two." (3) Failure to place the decimal point correctly was the greatest cause of errors in addition, 3 plus 5 plus 8 equals 15 being the most common type.

(4) The number of errors in addition due to inaccuracy was about half as great as the number of errors due to the misplacement of the decimal point.

(5) The greatest difficulties in subtraction were in borrowing and in the placement of the decimal number in the answer. There were few errors due to inaccuracy.

(6) The major difficulty in multiplication of decimals was the misplacement of the decimal point or its complete omission. (7) There were many errors due to inaccuracy in multiplication.

(8) The major causes of errors in division were the misplacement of the decimal point, faulty placement of zeros, omission of the decimal point, and inaccuracy.

The following types of examples were found by Thurstone in his investigation to present the greatest amount of difficulty to the pupils in each of the four processes of decimals:

Addition

$$\begin{array}{r} 1. \quad 2.75 \\ \quad 4 \\ \hline 16.375 \end{array}$$

2. Find the sum of .8 plus 3 plus .125.

$$\begin{array}{r} 3. \quad .28 \\ \quad .43 \\ \hline .95 \end{array}$$

4. 25 plus $\frac{1}{4}$ equals

$$\begin{array}{r} 5. \quad .3 \\ \quad .5 \\ \hline .8 \end{array}$$

Subtraction

$$\begin{array}{r} 1. \quad 18.2 \\ \quad 1.625 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \quad .4 \\ \quad .375 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad .6 \\ \quad .004 \\ \hline \end{array}$$

4. Subtract 3.825 from 20.

5. Subtract .5 from .75.

Multiplication

$$\begin{array}{r} 1. \quad 4.647 \\ \quad 5 \\ \hline \end{array}$$

2. .5 times .03

3. 200 times 9.4

4. $\frac{3}{8}$ of 6.4 equals5. .08 times 25 times $\frac{1}{2}$ equalsDivision

1. 87 divided by 33

2. 3 divided by .4

3. 9 divided by .12

4. 6 divided by .3

5. 10 divided by .2

6. 4 divided by .7

Author's Note:

It is obvious that Brueckner's test material as here quoted is quite beyond average adult usage, and, therefore, not proper material for drill mastery in the grades.

Addition

1.	2.75	3.	Find the sum of 2 plus 2 plus 1.25.
	<u>16.375</u>		
2.	28	4.	25 plus 2 equals
	<u>22</u>		
	<u>25</u>		

Subtraction

1.	19.5	2.	4
	<u>1.825</u>		<u>3.75</u>
4.	Subtract 2.825 from 20.		
5.	Subtract 2 from 75.		

Multiplication

1.	4.547	2.	5 times .03
	<u>2</u>		
4.	5/8 of 2.4 equals	5.	08 times 23 times 4 equals

Division

1.	27 divided by 33	2.	3 divided by 4
3.	2 divided by 12	4.	3 divided by 3
5.	10 divided by 2	6.	4 divided by 7

Author's Note:

It is obvious that Greenham's test material as here quoted is quite beyond average adult usage, therefore, not proper material for drill mastery in the grades.

III. THE USES OF DECIMALS IN BUSINESS

THE USES OF ORIGINALS IN BUSINESS

Chandler & Company is a private company and its affairs are not open to public inspection. It is a company which has been in existence for many years and has a long and successful record. The company is a private company and its affairs are not open to public inspection. It is a company which has been in existence for many years and has a long and successful record. The company is a private company and its affairs are not open to public inspection. It is a company which has been in existence for many years and has a long and successful record.

During the period of Chandler & Company, Mr. Chandler, the owner, was in the United States and was in the United States. The company was in the United States and was in the United States. The company was in the United States and was in the United States. The company was in the United States and was in the United States. The company was in the United States and was in the United States.

1. CHANDLER & COMPANY

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J. CHANDLER & COMPANY

Chandler & Company ranks among the leading department stores of Boston. It is located at 151 Tremont Street and carries a full line of misses', junior misses', girls', and female childrens' (from two years up) ready-to-wear clothing. Primarily, the policy of this company is to cater only to a female clientele, but since December, 1934, a new experiment has been in process with the opening of a mens' furnishings department.

During my research at Chandler's, Mr. Reginald C. Downes, manager of the accounts payable in the accounting department was of material assistance in presenting me with as much material as was the company's policy to divulge. My study was made on the dates of January third and fourth, 1935; in addition I visited Mr. Downes' office on several occasions during the month of January for the purposes of clearing up all matters relevant to my research.

The most important facts are as follows:

There are five hundred persons employed at Chandler & Company, grouped under nine subdivisions which include the office help, selling force, shipping group, receiving and marking force, buyers, advertising staff, maintenance crew, workrooms help, and an unclassified force which is comprised chiefly of telephone operators.

There are eighty persons employed in the offices. Ten of these employees use decimals to three places in their work

Chandler & Company ranks among the leading department stores of Boston. It is located at 151 Tremont Street and carries a full line of men's, junior misses', girls', and women's children's (from two years up) ready-to-wear clothing. Primarily, the policy of this company is to cater only to a female clientele, but since December, 1934, a new experiment has been in process with the opening of a men's furnishings department.

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There are thirty persons employed in the office. Ten of these employees are assigned to three places in their work

which involves for the most part the figuring of percentages in daily and monthly reports. "But," said Mr. Downes, "the other seventy might just as well have no knowledge at all about decimals insofar as their work here is concerned, because they have neither need nor occasion to use them."

The selling force is composed of two hundred and sixty-one employees who use decimals only to a very small extent. In fact the only occasions when the salespeople actually compute decimals are when they figure discounts on purchases made by other employees of the company. A discount of 15% is allowed each employee on all purchases and the calculations are carried out to three places to determine whether or not an extra cent will be allowed in the amount of discount.

There are twenty-seven buyers and they all have occasions to use decimals, especially in figuring percentages of markups which are carried out to three places. At this point I shall illustrate the markup procedure as used by the buyers in this concern:

Womens' hats costing \$ 24.00 a dozen, or \$ 2.00 each are to sell for \$ 3.95 each. The formula is as follows:

Selling Price	\$ 3.95
Cost	2.00
Markup	<u>\$ 1.95</u>

Percentage of
Markup \$ 1.95 divided by \$ 3.95

which is .493

The work of the advertising department is to draw up advertisements and release them to newspapers through the office. Consequently the members of the staff with the exception of the head of the department are not required to have a working knowledge of decimals but a reading knowledge only. The manager of the advertising department extends his calculations to three places, and his findings are included in his monthly reports to the accounting office.

The receiving and marking force label and tag the merchandise which is received before these goods are sold. A reading knowledge of decimals at best may be helpful to the employees in this group. And even this small knowledge of decimals proves to be practically negligible in their work because all of the markings are in some sort of printed form.

The remainder of the employees, the shipping, maintenance, workrooms, and unclassified forces have no occasion to use decimals, and, therefore, they need no knowledge of decimals in any form whatsoever.

In my study I obtained all the monthly reports for November, 1934. In all, there were 1,329 instances in which decimals occurred, all of which involved percentages.

In the purchases report, one hundred fifty-two decimals were used, all of three place figures. These decimals were used in such percentage findings as the relationship of the

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In the purchased report, one hundred fifty-two decimals were used, all of these place figures. These decimals were used in such percentage findings as the relationship of the

cost of merchandise to the selling price, the net percentage of gain in purchases for the month, and the percentage of expenses to sales.

There were sixty-six three place decimals used in the departmental report and they showed the percentages of departmental expenses, credits, markups, markdowns, and inventory, together with a percentage of increase or decrease from the standard figures as determined in the general budget.

Sixty-seven three place decimals were noted in the advertising report. These decimals typified the percentages of advertising expenses which were allocated among the various departments incurring these expenses

In the buyer's report there occurred three hundred and eighty-five decimals, all of three places. Percentages were figured for gross profit, discounts, credits, and markdowns on the merchandise bought and sold. Below are two samples of a buyer's report for the month of October, 1934. It compares the figures of the current period to those of a similar period of the previous year. They follow:

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(a)

Department 73; Street Floor HatsMonth of October, 1934.Buyer Miss Jaquith

	<u>1933</u>	<u>1934</u>
Net Sales	\$ 12,957.00	\$ 13,636.00
Gross Profit	44.4%	43.9%
Discount	8.0%	7.2%
Credits	13.6%	13.7%
Markdowns	1.7%	1.5%

(b)

Department 72; Inexpensive MillineryMonth of October, 1934.

Buyer _____

	<u>1933</u>	<u>1934</u>
Net Sales	\$ 1,010.00	\$ 670.00
Gross Profit	35.0%	44.9%
Discount	8.0%	7.1%
Credits	7.1%	8.6%
Markdowns	6.2%	----

The stock turnover report disclosed thirty-one decimals, all of which extended to four places. These percentages revealed the rate of turnover for merchandise, and the rate of increase and decrease of such ratios as compared to standardized budget figures.

There were sixty-eight three place decimals occurring in the daily orders placed report which involved the finding of percentages of cost allotted to the various departments which incurred these expenditures.

The operating report showed five hundred and sixty instances where three place decimals had been used. All of these decimals were concerned with percentage ratios. They included the percentages of markups, markdowns, discounts, credits and allowances, net gain in sales, net gain in purchases, percentage of loss on uncollectable accounts, percentage of expenses to the sales volume, percentage of gross profit, percentage of net profit, and percentage of change in capital.

Table III on page 18 summarizes the decimal findings in relation to their source and number of places. Only a few actual decimals could be procured by the writer and these have been illustrated elsewhere in this paper.

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Table III on page 18 summarizes the decimal findings in relation to their source and number of places. Only a few actual decimals could be presented by the writer and these have been illustrated elsewhere in this paper.

The data as to persons using decimals at Chandler and Company is presented in Table IV on the following page.

III. Table Showing Distribution of Decimals in the Monthly Reports of Chandler & Company as of November 30, 1934.

Sources of Decimals	Number of Three Place Decimal Items	Number of Four Place Decimal Items	Totals
Purchases Report	152		152
Departmental Report	66		66
Advertising Report	67		67
Buyer's Report	385		385
Stock Turnover Report		31	31
Daily Orders Placed	68		68
Operating Report	560		560
Totals	1298	31	1329

III. Table Showing Distribution of Decimals in the Monthly Reports of Chandler & Company as of November 30, 1934.

Source of Decimals	Number of Three Place Decimal Items	Number of Four Place Decimal Items	Totals
Purchase Report	152		152
Departmental Report	66		66
Advertising Report	67		67
Buyer's Report	333		333
Stock Turnover Report		21	21
Daily Goods Placed	66		66
Operating Report	333		333
Totals	1298	21	1329

The facts as to persons using decimals at Chandler and Company is contained in Table IV on the following page.

IV. Table Showing the Personnel and Amount of Decimal Knowledge Secured at Chandler & Company

Office of Personnel	No. having no knowledge of decimals	No. having slight knowledge of decimals	No. having good knowledge of decimals	Total
Office	70		10	80
Selling			100	100
Shipping	5			5
Receiving & Sorting		10		10
Buying			15	15
Advertising		10		10
Administration	20			20
Workroom	25			25
Unemployed	5			5
Total	140	20	25	185

The facts as to persons using facilities at Chandler and

Company is contained in Table IV on the following page.

Table IV is partially self-explanatory. Of the five hundred employees at Chandler & Company, seventy office workers, eight shippers, thirty maintenance workers, fifty-five workrooms men, and nine unclassified operators need no knowledge of decimals in their work. This group represents 34.2% of the total. There are ten advertising workers and twenty of the receiving and marking force, representing 4% of the total, that need a reading knowledge of decimals. However, they do not need

IV. Table Showing The Personnel and Amount of Decimal Knowledge Needed At Chandler & Company

Split-up of Personnel	No. needing no knowledge of decimals	No. needing a reading knowledge	No. who compute decimals	Totals
Office	70		10	80
Selling			261	261
Shipping	8			8
Receiving & Marking		20		20
Buying			27	27
Advertising		10		10
Maintenance	30			30
Workrooms	55			55
Unclassified	9			9
Total	172	30	298	500

IV. Table Showing the Personnel and Amount of Technical Knowledge Needed At Chandler & Company

Split-up of Personnel	No. needing no knowledge of technicals	No. needing a reading comparative	No. who comparative technicals totals
Office	70		80
Selling			80
Shipping	8		8
Receiving & Marking		20	20
Buying		27	27
Advertising		10	10
Maintenance	30		30
Workrooms	25		25
Unassigned	9		9
Total	172	30	202

Table IV is partially self-explanatory. Of the five hundred employees at Chandler & Company, seventy office workers, eight shippers, thirty maintenance workers, fifty-five work-rooms men, and nine unclassified operators need no knowledge of decimals in their work. This group represents 34.4% of the total. There are ten advertising persons and twenty of the receiving and marking force, representing 6% of the total, that need a reading knowledge of decimals. However, they do not need to read beyond three places, and so comparatively few if any difficulties are encountered. Those who actually figure decimals are ten members of the office force, two hundred and sixty-one salespeople and twenty-seven buyers. This number is 59.6% of the total. For the most part three place decimals are figured, and in a few instances four place decimals are calculated, all in per cents.

These groupings are shown in Chart I on the next page.

Table IV is partially self-explanatory. Of the five hundred employees at Chandler's Company, seventy office workers, eight shipbuilders, thirty maintenance workers, fifty-five workroom men, and nine unclassified operators need no knowledge of decimals in their work. This group represents 34.4% of the total. There are ten advertising persons and twenty of the receiving and marketing force, representing 6% of the total, that need a reading knowledge of decimals. However, they do not need to read beyond three places, and so comparatively few if any difficulties are encountered. Those who actually figure decimals are ten members of the office force, two hundred and sixty-one salespeople and twenty-seven buyers. This number is 63.6% of the total. For the most part three place decimals are figured, and in a few instances four place decimals are calculated, all in per cents.

These groupings are shown in Chart I on the next page.

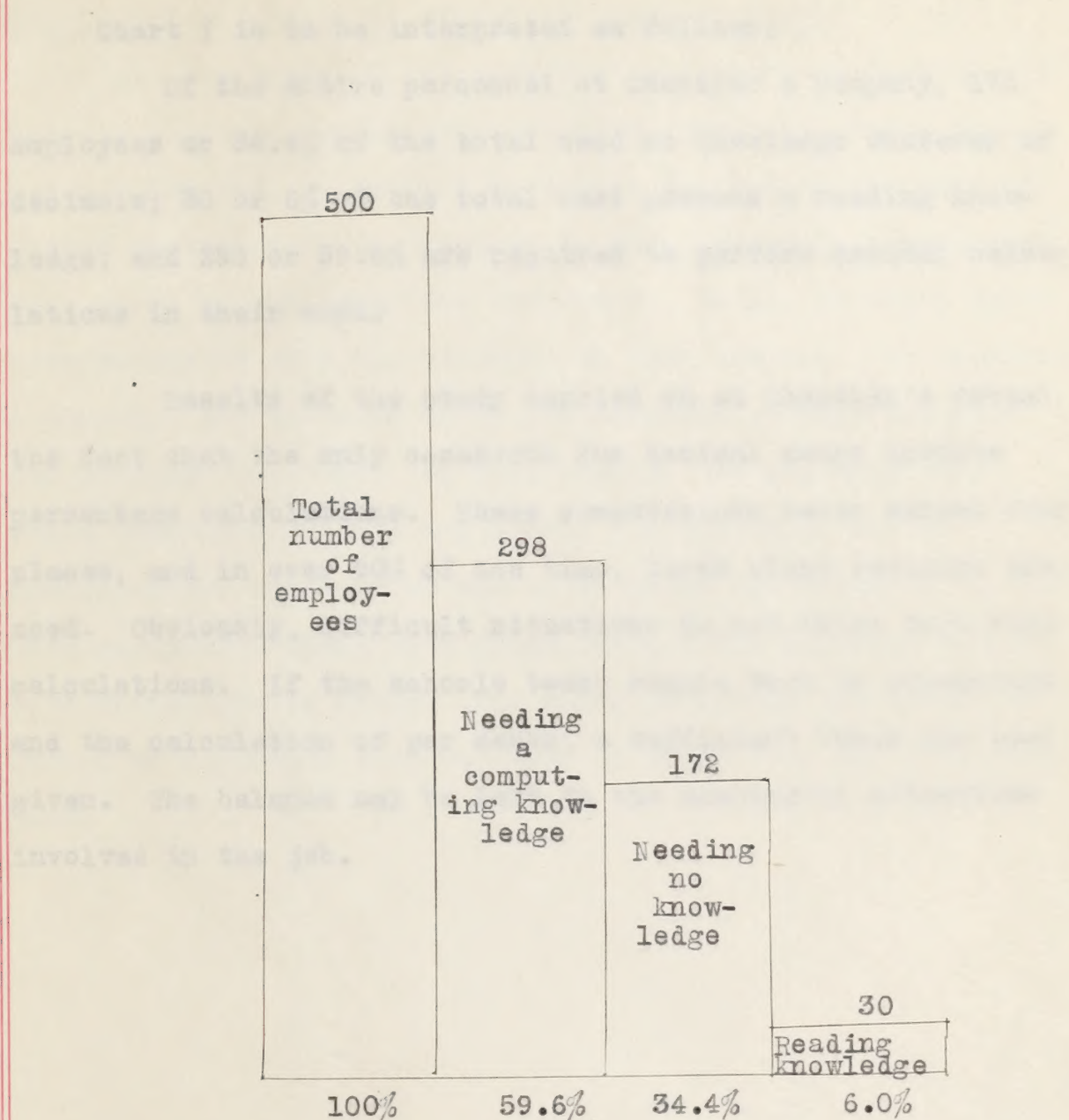


Chart I.--Showing the Number of Employees and Extent of Decimal Knowledge Which Is in Use at Chandler and Company.

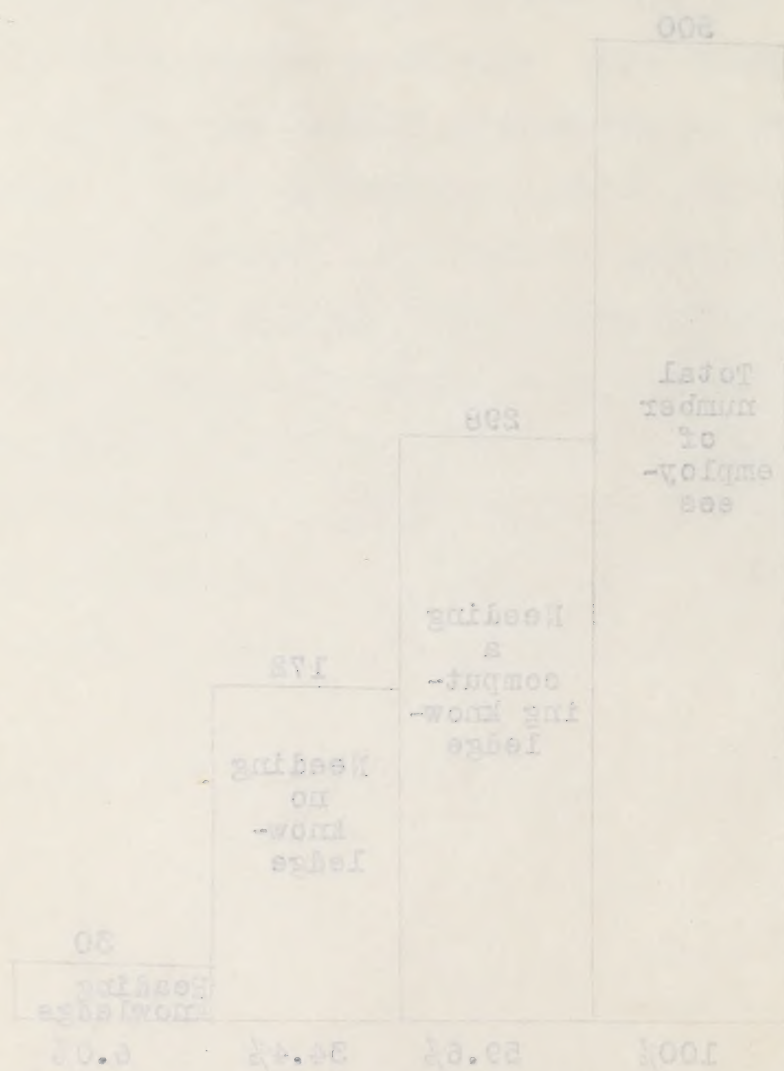


Chart I.--Showing the number of employees and extent of decimal knowledge which is in use at Chandler and Company.

Chart I is to be interpreted as follows:

Of the entire personnel at Chandler & Company, 172 employees or 34.4% of the total need no knowledge whatever of decimals; 30 or 6% of the total must possess a reading knowledge; and 298 or 59.6% are required to perform decimal calculations in their work.

Results of the study carried on at Chandler's reveal the fact that the only occasions for decimal usage involve percentage calculations. These computations never exceed four places, and in over 90% of the time, three place decimals are used. Obviously, difficult situations do not arise from such calculations. If the schools teach simple work in percentage and the calculation of per cents, a sufficient basis has been given. The balance may be left to the meaningful situations involved in the job.

Chart I is to be interpreted as follows:

Of the entire personnel at Chandler & Company, 14% employees or 34.4% of the total need no knowledge whatsoever of decimals; 50 or 6% of the total must possess a reading knowledge; and 398 or 59.6% are required to perform decimal calculations in their work.

Results of the study carried on at Chandler's reveal

the fact that the only occasions for decimal usage involve percentage calculations. These computations never exceed four places, and in over 90% of the time, three place decimals are used. Obviously, difficult situations do not arise from such calculations. If the schools teach simple work in percentage and the calculation of per cents, a sufficient basis has been given. The balance may be left to the meaningful situations involved in the job.

Supplement---Bearing No Direct Relation To Study

When the writer first undertook the study of decimal usages in business he included decimals involving United States money. However, it was not advisable to include the uses of United States money as decimals in this research, consequently this phase of the study was abandoned. Still, it might prove interesting to note the findings in this respect. At Chandler & Company, 125 incoming bills for merchandise were examined for December 27, 1934. Of this number, 520 decimals were found involving dollars and cents. In addition, 828 or approximately one-half of the sales slips for December 31, 1934 were examined. There were found to be 2,061 decimals dealing with United States money. The actual decimals and their frequency of occurrence will be shown in Table V on the following page.

Supplement--Learning No Direct Relation To Study

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page.

V. Table Showing the Frequency of
occurrence of decimals dealing with
United States money.

Decimals	Incoming Bills	Sales Slips	Total
.00	128	644	772
.01		2	2
.02	3	3	6
.03	2		2
.04	2		2
.05	5	3	8
.06	4	1	5
.07	2	7	9
.08	2	6	8
.09		4	4
.10	5	19	24
.11			
.12	5		5
.13	1	2	3
.14	3	5	8
.15	8	25	33
.16	4	6	10
.17	1	2	3
.18	3	22	25
.19	3	2	5
.20	7	11	18
.21	1		1
.22	1	2	3
.23	1		1
.24	2		2
.25	21	98	119
.26	2		2
.27	1	2	3
.28	3	3	6
.29	1	2	3
.30	7	22	29
.31	3	2	5
.32	3	2	5
.33	2		2
.34			
.35	16	29	45
.36	4	2	6
.37		1	1
.38	3	19	22
.39		8	8
.40	8	8	16
.41			
.42	2	2	4
.43		1	1
.44	1		1

V. Table showing the frequency of occurrence of decimals dealing with United States money.

Decimals	Income	Sales	Total
00.	128	644	772
01.		3	3
02.	3	3	6
03.	3		3
04.	3		3
05.	3	3	6
06.	4	1	5
07.	3	7	10
08.	3	3	6
09.		4	4
10.	5	19	24
11.			
12.	3		3
13.	1	3	4
14.	3	3	6
15.	3	33	36
16.	4	3	7
17.	1	3	4
18.	3	33	36
19.	3	3	6
20.	7	11	18
21.	1		1
22.	1	3	4
23.	1		1
24.	3		3
25.	13	33	46
26.	3		3
27.	1	3	4
28.	3	3	6
29.	1	3	4
30.	7	33	40
31.	3	3	6
32.	3	3	6
33.	3		3
34.			
35.	13	33	46
36.	4	3	7
37.		1	1
38.	3	19	22
39.	3	3	6
40.	3	3	6
41.			
42.	3	3	6
43.	1	1	2
44.	1		1

Table V--continued

<u>Decimals</u>	<u>Incoming Bills</u>	<u>Sales Slips</u>	<u>Total</u>
.45	2	43	45
.46	1	2	3
.47			
.48	1	14	15
.49		1	1
.50	72	224	296
.51	1		1
.52	2	2	4
.53	1	3	4
.54			
.55		13	13
.56	4	2	6
.57	1	2	3
.58	2	7	9
.59		15	15
.60	6	4	10
.61	1	6	7
.62			
.63	1	1	2
.64	4	2	6
.65	5	50	55
.66	2		2
.67		2	2
.68	1	12	13
.69	3	25	28
.70	4	26	30
.71			
.72	1	2	3
.73		1	1
.74		21	21
.75	74	202	276
.76	1	16	17
.77	1		1
.78	3	6	9
.79	1		1
.80	11	7	18
.81	1	3	4
.82			
.83			
.84	2		2
.85	4	65	69
.86		4	4
.87		14	14
.88	3	2	5
.89	1	4	5
.90	4	26	30
.91	1	4	5
.92	2		2
.93		2	2
.94	1	13	14

Table V--continued

Decimals	Income	Sales	Total
43.	3	33	33
44.	1	3	3
45.			
46.	1	14	15
47.		1	1
48.	27	282	289
49.	1		1
50.	2	2	4
51.	1	3	4
52.			
53.		13	13
54.	4	3	7
55.	1	3	4
56.	2	7	9
57.		13	13
58.	3	4	7
59.	1	3	4
60.			
61.	1	3	4
62.	1	1	2
63.	4	3	7
64.	2	30	32
65.			
66.	2	3	5
67.	1	13	14
68.	2	23	25
69.	4	23	27
70.			
71.	1	3	4
72.		1	1
73.		13	13
74.		27	27
75.	27	303	330
76.	1	13	14
77.	1		1
78.	3	3	6
79.	1		1
80.	11	7	18
81.	1	3	4
82.			
83.			
84.	2	33	35
85.	4	33	37
86.		4	4
87.		14	14
88.	3	3	6
89.	1	4	5
90.	4	33	37
91.	1	4	5
92.	2		2
93.		13	13

Table V---continued

	<u>Decimals</u>	<u>Incoming Bills</u>	<u>Sales Slips</u>	<u>Total</u>
	.95	20	239	259
	.96	4		4
	.97	1	5	6
	.98			
	.99		2	2
Totals	<u> </u>	<u>520</u>	<u>2061</u>	<u>2581</u>

The tabulations made in Table V clearly show, except in a few instances a recording for all of the two place decimals. The most frequent decimal occurring was .00, if such may be called a decimal. The actual number of occurrences for .00 was 772, or 29.91% of the total frequency. The decimals ending in five and zero show a frequency of 2,165 occurrences or 83.88% of all the occurrences as against 416 occurrences or 16.12% of the total for the remaining eighty two-place decimals. The four decimals found to occur the greatest number of times were .00, .25, .50, and .75 showing a frequency of 1,446 occurrences or 56.02% of the total as against 1,035 occurrences or 43.98% of the other ninety-six two place decimals combined. However, it should be noted that dollars and cents do not involve difficulties for children, as do abstract decimals as such.

Table V---continued

Decimals	Incoming Slips	Sales Slips	Total
.95	20	239	259
.96	4		4
.97	1	5	6
.98			
.99		2	2
Totals	250	250	250

The tabulations made in Table V clearly show, except in a few instances a recording for all of the two place decimals. The most frequent decimal occurring was .00, it may be called a decimal. The actual number of occurrences for .00 was 775, or 31.4% of the total frequency. The decimals ending in five and zero show a frequency of 8,168 occurrences or 32.6% of all the occurrences as against 415 occurrences or 16.6% of the total for the remaining eighty-two place decimals. The four decimals found to occur the greatest number of times were .00, .25, .50, and .75 showing a frequency of 1,448 occurrences or 58.0% of the total as against 1,033 occurrences or 41.2% of the other ninety-six two place decimals combined. However, it should be noted that dollars and cents do not involve difficulties for children, as do abstract decimals as such.

The Forest Hills Hospital, a relatively new institution, is located at 1110 Forest Hills Avenue, New York 17, New York. It is a private hospital and is one of the largest in the city. The hospital is a modern building with a large central tower and many wings. It is a well-known institution and is one of the best in the city. It is a private hospital and is one of the largest in the city. It is a well-known institution and is one of the best in the city. It is a private hospital and is one of the largest in the city. It is a well-known institution and is one of the best in the city.

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2. FOREST HILLS HOSPITAL

The Forest Hills Hospital is a private institution and is one of the largest in the city. It is a well-known institution and is one of the best in the city. It is a private hospital and is one of the largest in the city. It is a well-known institution and is one of the best in the city. It is a private hospital and is one of the largest in the city. It is a well-known institution and is one of the best in the city. It is a private hospital and is one of the largest in the city. It is a well-known institution and is one of the best in the city. It is a private hospital and is one of the largest in the city. It is a well-known institution and is one of the best in the city.

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The Forest Hills Hospital, a relatively small institution, as compared to our larger New England hospitals is located at 29 Morton Street, in the Forest Hills section of Boston. Its facilities are quite modern and the institution adequately provides care for the illnesses of one hundred and fifty patients. All but contagious cases are treated at this hospital.

The writer visited Doctor Shadman who is the managing director at the hospital, on February 15, 1935, and as a result of his research there the following facts were found to be true:

The entire personnel of the institution consists of seventy-four members. Of this number there are forty nurses, all of whom figure decimals in their work. One use of decimals is the taking of patient's temperatures and recording them on the temperature charts. The thermometers used for this purpose can determine a patient's temperature to a tenth of a degree. The temperature of a normal person is 98.6 degrees Fahrenheit, and the thermometer indication shows exactly how much each patient's temperature deviates from the normal. All temperature readings are recorded on charts which are also scaled in tenths of degrees so that the exact recordings may be made

The nurses also use decimals in preparing and weighing materials for standard solutions. Mrs. O'Leary, who is the superintendent of the hospital and nurses said that decimals as far as eight places are sometimes used in such calculations although the general use of decimals in the laboratory does not

The Forest Hills Hospital, a relatively small institution, as compared to our larger New England hospitals is located at 22 Norton Street, in the Forest Hills section of Boston. Its facilities are quite modern and the institution adequately provides care for the illnesses of one hundred and fifty patients. All but contagious cases are treated at this hospital.

The writer visited Doctor Shadman who is the managing director at the hospital, on February 15, 1935, and as a result of his research there the following facts were found to be true:

The entire personnel of the institution consists of seventy-four members. Of this number there are forty nurses, all of whom figure decimals in their work. One use of decimals is the taking of patient's temperatures and recording them on the temperature charts. The thermometers used for this purpose can determine a patient's temperature to a tenth of a degree. The temperature of a normal person is 98.6 degrees Fahrenheit, and the thermometer indication shows exactly how much each patient's temperature deviates from the normal. All temperature readings are recorded on charts which are also scaled in tenths of degrees so that the exact recording may be made.

The nurses also use decimals in preparing and weighing materials for standard solutions. Mrs. O'Leary, who is the superintendent of the hospital and nurses said that decimals as far as eight places are sometimes used in such calculations although the general use of decimals in the laboratory does not

go beyond five places. In all scientific calculations decimals are used as far as three places. Some illustrations of decimals noted at the hospital are as follows:

- (1) .022368 cubic centimeters of urea nitrogen.
- (2) .0005 grams of nitrogen (standard for new protein nitrogen in 100 cubic centimeters of amonium sulphate)
- (3) .588 a percentage calculation for urinary nitrogen
- (4) 4.716 grams (standard for 100 cubic centimeters of amonium sulphate)
- (5) .922 a barometric reading indicating good weather.
- (6) 1.65 indicating square meters in body surface area of a metabolism test.
- (7) 39.6 the standard number of calories per square meter per hour for a twenty year old normal female.

The managing director calculates decimals in his medical work; he also needs a knowledge of decimals to interpret both medical and business reports.

There are three house doctors who need a knowledge of decimals in the writing and preparation of prescriptions and in the interpretation of sick patient reports. Such decimals seldom go beyond five places.

In the office there are four clerks none of whom need a decimal knowledge in any form. When the author remarked that this was unusual he was told that an auditor, who came into the office periodically, checked the books and drew up all the reports and statements thus relieving the clerks of these duties. The decimals computed in these financial reports never extend

beyond three places.

The hospital laundry employs five persons none of whom, with the exception of the foreman need a knowledge of decimals at all. The foreman calculates decimals only to two places in figuring the strength of washing solutions.

The remaining number of employees, eleven kitchen workers, three housekeepers, three firemen, and three housemen do not use decimals in any form, and as far as their work at this institution is concerned, they need no knowledge of decimals.

Table VI on page 32 contains in condensed form a summary of the facts as they exist at the Forest Hills Hospital.

Laundry	5			5
Kitchen	11			11
Housekeepers	3			3
Housemen	3			3
Firemen	3			3
Totals	25	46		74

beyond three places.

The hospital laundry employs five persons none of whom, with the exception of the foreman, had a knowledge of decimals at all. The foreman calculates decimals only to two places in figuring the strength of washing solutions.

The remaining number of employees, eleven kitchen workers, three housekeepers, three firemen, and three nurses do not use decimals in any form, and as far as their work at this institution is concerned, they need no knowledge of decimals. Table VI on page 33 contains in condensed form a summary of the facts as they exist at the Forest Hills Hospital.

VI. Table Showing the Personnel and Amount of Decimal Knowledge Needed at the Forest Hills Hospital.

Split-up of Personnel	No. needing no knowledge of decimals	No. who compute decimals	Sample Decimal	Totals
Executive		2	.022368	2
Office	4			4
Nurses		40	.0005	40
House Doctors		3	.196	3
Laundry	4	1	.2	5
Kitchen	11			11
Housekeepers	3			3
Housemen	3			3
Firemen	3			3
Totals	28	46		74

VI. Table showing the Personnel and Amount of Dental Knowledge Needed at the Forest Hills Hospital.

Split-up of Personnel	No. needing no knowledge of dentistry	No. who operate dentistry	Sample Dental	Totals
Executive		2	.000000	2
Office	4			4
Nurses		40	.0000	40
House Doctors		3	.100	3
Dentistry	4	1	.2	5
Kitchen	11			11
Horsekeepers	3			3
Horsemen	3			3
Firemen	3			3
Totals	28	46		74

Table VI is partially self-explanatory. Of the seventy-four employees at the Forest Hills Hospital, two executives, forty nurses, three house doctors and one laundry foreman need a computing knowledge of decimals in some form. This number represents 62.16% of the total. The four office clerks, eleven kitchen workers, three housekeepers, three firemen and three housemen, representing 37.84% of the total need to possess no knowledge whatever that relates to decimal figurings or calculations.

These groupings are shown in Chart II on the following page.

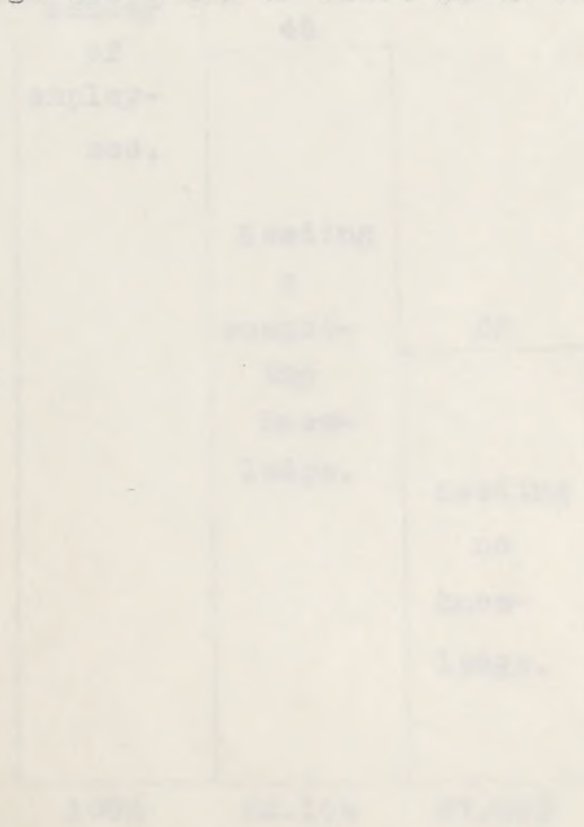


Chart II--Showing the number of employees and percent of decimal knowledge at the Forest Hills Hospital.

Table VI is partially self-explanatory. Of the seventy-four employees at the Forest Hills Hospital, two executives, forty nurses, three house doctors and one laundry foreman need a computing knowledge of decimals in some form. This number represents 62.1% of the total. The four office clerks, eleven kitchen workers, three housekeepers, three firemen and three housemen, representing 37.9% of the total need to possess no knowledge whatever that relates to decimal figures or calculations.

These percentages are shown in Chart II on the following

page.

Chart II is to be interpreted as follows:

Of the entire personnel at the Forest Hills Hospital, 74 employees or 100% of the total need no knowledge whatever of decimals, while 46 or 62.16% are required to perform decimal calculations in their work. However the most difficult situations involving decimal computations arise in the Hospital laboratory where decimals ranging from one to eight places are required. Out of the 46 employees having decimal knowledge, 28 or 60.87% are required to use decimals in their work. The remaining 18 employees or 39.13% are required to use decimals in their work. The professional staff of the Hospital are required to use decimals in their work.

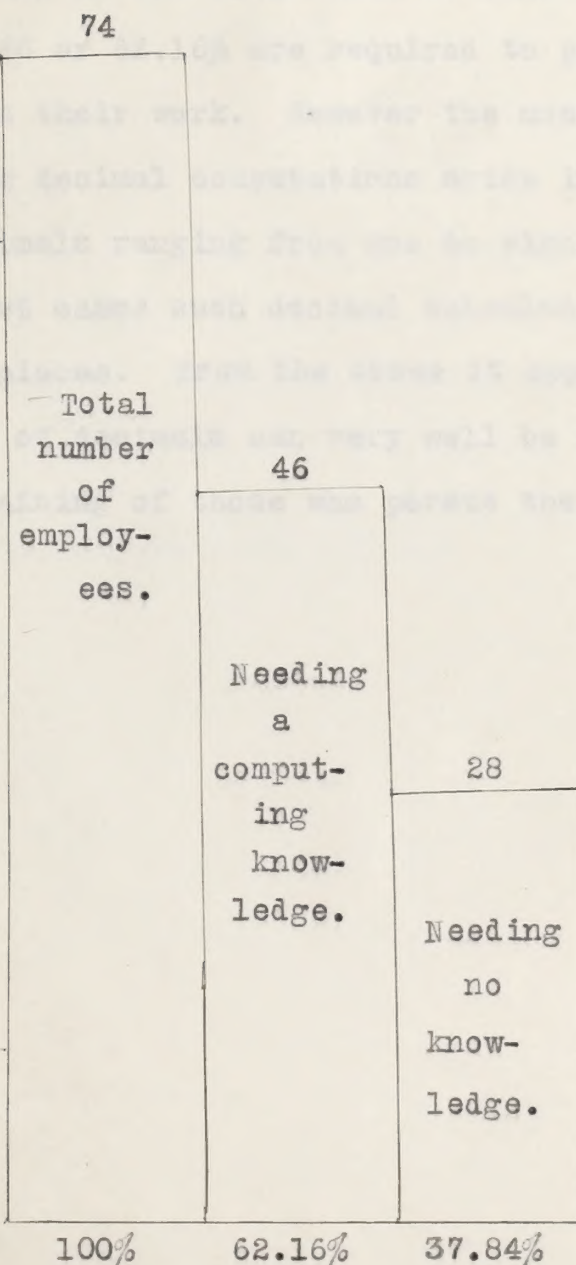


Chart II--Showing the Number of Employees and Extent of Decimal Knowledge in Use at the Forest Hills Hospital.

Chart 11--Showing the Number of Employees and Extent of
 Decimal Knowledge in Use at the Forest Hill
 Hospital.

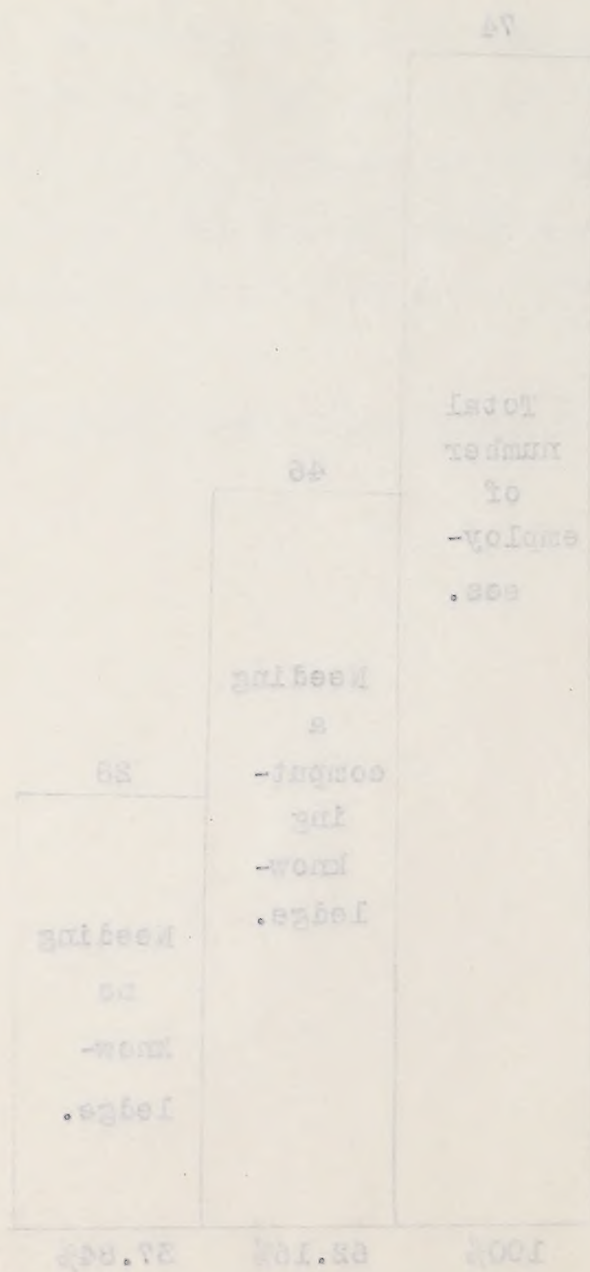


Chart II is to be interpreted as follows:

Of the entire personnel at the Forest Hills Hospital, 28 employees or 37.84% of the total need no knowledge whatever of decimals, while 46 or 62.16% are required to perform decimal calculations in their work. However the most difficult situations involving decimal computations arise in the hospital laboratory where decimals ranging from one to eight places are figured. But in most cases such decimal calculations do not extend beyond five places. From the above it appears that training in the use of decimals can very well be included in the professional training of those who pursue the field of medicine.

Chart II is to be interpreted as follows:

Of the entire personnel at the Forest Hills Hospital, 28 employees or 37.8% of the total need no knowledge whatever of decimals, while 43 or 56.1% are required to perform decimal calculations in their work. However the most difficult situations involving decimal computations arise in the hospital laboratory where decimals ranging from one to eight places are required. But in most cases such decimal calculations do not extend beyond five places. From the above it appears that training in the use of decimals can very well be included in the professional training of those who serve the field of medicine.

The Otis Elevator Company, located at 100 Chapel Street in Boston, is the largest of its kind in existence, having the largest staff of salesmen in the world. The principal lines of this company are in manufacturing, sell, repair and service elevators, dumb-waiters, escalators, gravity conveyors (spiral chutes), belt conveyors, and other appliances.

The Boston office is the New England area headquarters, and is composed of a personnel of over two hundred and fifty. There are thirteen offices under the jurisdiction of the Boston area, each office being established in a New England city. Of these thirteen offices, six are strictly service, and the other seven are sales. In other words, only two offices are allowed to go out in the field for new prospects, the other six are strictly service and repairs for the present clientele.

3. OTIS ELEVATOR COMPANY

During the preparation of the New England headquarters which was begun in February 1935, the writer had interviews with Mr. William B. Todd, the purchasing agent. As a member of this organization for a great number of years, Mr. Todd has a lifetime of experience behind him and he outlined the writer in a very great extent in the story which was undertaken. The following were found by the writer:

There are two hundred and fifty-two persons employed at the Otis Elevator Company's Boston office. They are classified under four departments, namely, accounting, construction, sales and service. The sales department is the largest, having about one hundred and twenty-five persons. The service department has about one hundred persons. The construction department has about twenty-five persons. The accounting department has about twenty-five persons. The writer was given a tour of the office and was shown the various departments and the work being done. The writer was also shown the various pieces of equipment and the various types of elevators and dumb-waiters. The writer was also shown the various types of escalators and gravity conveyors. The writer was also shown the various types of belt conveyors and spiral chutes. The writer was also shown the various types of other appliances.

There are two hundred and fifty-two persons employed at the Otis Elevator Company's Boston office. They are classified under four departments, namely, accounting, construction, sales and service. The sales department is the largest, having about one hundred and twenty-five persons. The service department has about one hundred persons. The construction department has about twenty-five persons. The accounting department has about twenty-five persons. The writer was given a tour of the office and was shown the various departments and the work being done. The writer was also shown the various pieces of equipment and the various types of elevators and dumb-waiters. The writer was also shown the various types of escalators and gravity conveyors. The writer was also shown the various types of belt conveyors and spiral chutes. The writer was also shown the various types of other appliances.

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The Otis Elevator Company, located at 130 Clarendon Street, in Boston, is the largest of its kind in existence, having 339 offices throughout the principal cities of the world. The business of this company is to manufacture, sell, repair and service elevators, dumb-waiters, escalators, gravity conveyers (spiral chutes), belt conveyers, and whip hoists.

The Boston office is the New England zone headquarters, and is comprised of a personnel of over two hundred and fifty. There are eighteen offices under the jurisdiction of the Boston zone, each office being established in a New England city. Of these eighteen branch offices, sixteen are strictly service, and two are service and sales. In other words, only two offices are allowed to go out in the field for new prospects, the other sixteen maintaining service and repairs for the present clientele.

During the research at the New England headquarters which was begun on February 26, 1935, the author had interviews with Mr. William C. Todd, the purchasing agent. As a member of this organization for a great number of years, Mr. Todd has a lifetime of experience behind him and he assisted the writer to a very great extent in the study which was undertaken. The following were found to be true:

There are two hundred and fifty-two persons employed at the Otis Elevator Company's Boston office. They are classified under four departments, namely, accounting, construction, sales

The Otis Elevator Company, located at 133 Winter Street in Boston, is the largest of its kind in existence, having 230 offices throughout the principal cities of the world. The business of this company is to manufacture, sell, repair and service elevators, dumb-waiters, escalators, gravity conveyors (cable cars), belt conveyors, and winch hoists.

The Boston office is the New England zone headquarters, and is comprised of a personnel of over two hundred and fifty. There are sixteen offices under the jurisdiction of the Boston zone, each office being established in a New England city. Of these sixteen branch offices, sixteen are strictly service, and two are service and sales. In other words, only two offices are allowed to go out in the field for new prospects, the other sixteen maintaining service and repairs for the present clientele.

During the research at the New England headquarters which was begun on February 26, 1935, the author had interviews with Mr. William C. Todd, the purchasing agent. As a member of this organization for a great number of years, Mr. Todd has a lifetime of experience behind him and he assisted the writer to a very great extent in the study which was undertaken. The following were found to be true:

There are two hundred and fifty-two persons employed at the Otis Elevator Company's Boston office. They are classified under four departments, namely, accounting, construction, sales

and service.

In the accounting department there are eight employees who are under the supervision of the head accountant. Of these eight, only three, the head accountant, his assistant, and a comptometer operator use decimals to five places for the purposes of preparing financial statements, reports and invoices. Such decimal calculations are for the most part in percents.

The construction department contains ten members who are under the direction of the construction manager. No decimals are computed by the manager or his assistant, but they must have a knowledge of decimals, however, in order to interpret the reports of the engineers and foremen.

Two engineers calculate decimals to five places in figuring hatchway and layout dimensions. Such computations must be exact in every detail because of the fine and delicate measurements which are used in the preparation of all subsidiary parts that make up the larger mechanisms. The foremen, three in number, set and check the guages on machines used in manufacture. Decimals of four places are set in the manufacturing process. However, a reading knowledge only of decimals is necessary in the foremens' work.

There is a total sales force of forty-eight persons who are supervised by the sales manager. All salesmen of the New England zone are stationed at headquarters here in Boston. Of

and service.

In the accounting department there are eight employees who are under the supervision of the head accountant. Of these eight, only three, the head accountant, his assistant, and a computer operator use decimals to five places for the purposes of preparing financial statements, reports and invoices. Such decimal calculations are for the most part in percents.

The construction department contains ten members who are under the direction of the construction manager. No decimals are computed by the manager or his assistant, but they must have a knowledge of decimals, however, in order to interpret the reports of the engineers and foremen.

Two engineers calculate decimals to five places in figuring highway and layout dimensions. Such computations must be exact in every detail because of the time and delicate measurements which are used in the preparation of all subsidiary parts that make up the larger mechanisms. The foremen, three in number, set and check the gages on machines used in manufacture. Decimals of four places are set in the manufacturing process. However, a reading knowledge only of decimals is necessary in the foremen's work.

There is a total sales force of forty-eight persons who are supervised by the sales manager. All salesmen of the New England zone are stationed at headquarters here in Boston. Of

the total number of salesmen, eight sell new elevators and equipment, twenty-eight sell repair service and modernization, while there are twelve salesmen at the office. None of these men need to compute any decimals whatsoever.

In the service department there are one hundred and eighty-six employees. The service manager and his assistant do not calculate decimals at all, although they must be able to interpret the decimal findings of those under their charge. Of the field force, which consists of one hundred and fifty-four employees, thirty, who are first class mechanics use decimals to five places for the purposes of calculating the measurements for parts and alignments of various machines. In addition, there are six local managers who figure decimals to four places in order to determine half-speeds, revolutions of motor, and alignment of machines.

The shop force is made up of ten members. Two of the four machine shop workers calculate decimals to four places in mechanical measurements; one of the four warehouse employees figures decimals to four places in pricing all materials bought and sold, and one of the two employees in the electrical shop computes decimals to four places in electrical measurements.

There are fourteen local service agents whose understanding of decimals would consist of a reading knowledge only to the extent of five places in their inspection of repairs and service.

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The shop force is made up of ten members. Two of the four machine shop workers calculate decimals to four places in mechanical measurements; one of the four warehouse employees figures decimals to four places in pricing all materials bought and sold, and one of the two employees in the electrical shop computes decimals to four places in electrical measurements.

There are fourteen local service agents whose understanding of decimals would consist of a reading knowledge only to the extent of five places in their inspection of repairs and services.

The following illustrates some actual usages of decimals observed at the Otis Elevator Company:

- (1) .00087 a percentage used for analysis purposes in a financial statement.
- (2) .00625 inches---- measurement of a hatchway and car.
- (3) .00315 inches---- clearance of one part to another.
- (4) .1069 a percentage used for analysis purposes in a financial statement.
- (5) .0021 inches---- reference to machine alignment.
- (6) 2500.0325 revolutions per minute.
- (7) 4.8763 inches---- measurement of a shaft.
- (8) 1.003 inches---- micrometer reading referring to the size of wire.

The data thus presented appear in condensed form in the following table.

The following illustrates some actual readings of the

observed at the Erie Elevator Company:

- | | | |
|-----|-----------|---|
| (1) | .00087 | a percentage used for analysis purposes in a financial statement. |
| (2) | .00025 | inches--- measurement of a hatchway and car. |
| (3) | .00315 | inches--- distance of one part to another. |
| (4) | .1009 | a percentage used for analysis purposes in a financial statement. |
| (5) | .00021 | inches--- reference to machine alignment. |
| (6) | 2500.0035 | revolutions per minute. |
| (7) | 4.8763 | inches--- measurement of a shaft. |
| (8) | 1.003 | inches--- micrometer reading referring to the size of wire. |

The data thus presented appears in condensed form in the

following table.

VII. Table Showing the Personnel and Amount of Decimal Knowledge Needed at the Otis Elevator Company.

Split-up of personnel	No. needing no knowledge of decimals	No. needing a reading knowledge	No. who compute decimals	Sample decimal	Totals
Accounting	5		3	.00076	8
Construction	3	5	2	.00625	10
Sales	48				48
Service	130	16	40	.00315	186
Totals	186	21	45		252

VII. Table showing the Personnel and Amount of Business Done -
 Jobs Needed at the Otis Elevator Company.

Split-up of personnel	No. needing no knowledge of business	No. needing a working knowledge	No. who compute business	Sample business	Total
Accounting	5		3	.00075	5
Construction	3	5	3	.00083	10
Sales	48				48
Service	130	16	40	.00313	186
Totals	186	21	46		253

Table VII is partially self-explanatory. Of the 252 employees at the Otis Elevator Company, 3 accountants, 2 construction men, and 40 service men compute decimals to five places. This number represents 17.86% of the total. There are 5 construction men and 16 service employees, or 8.33% of the total employees who need to have a reading knowledge of decimals in their work. However, the decimals with which these men come into contact never extend beyond five places. The remaining number of employees, 5 in the accounting department, and 130 in the service department, which represents 73.81% of the total, need no knowledge of decimals in any form in order to carry out their duties.

These groupings are summarized in Chart III on page 43.

Table VII is partially self-explanatory. Of the 500 employees at the Ellis Island Company, 3 construction men, and 40 service men comprise 43 of the total. This number represents 17.8% of the total. There are 5 construction men and 10 service employees, or 8.8% of the total employees who need to have a working knowledge of decimals in their work. However, the decimals with which these men come into contact never extend beyond five places. The remaining number of employees, 3 in the accounting department, and 100 in the service department, which represents 73.8% of the total, need no knowledge of decimals in any form in order to carry out their duties.

These findings are summarized in Chart III on page 45.

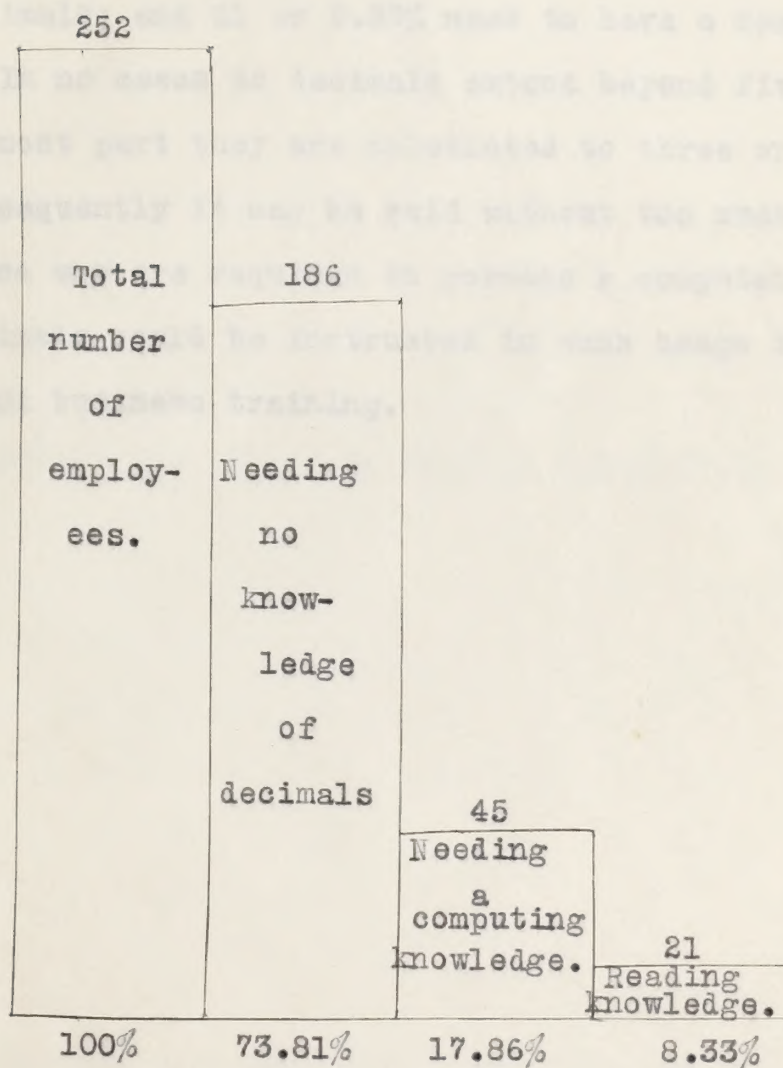


Chart III. Showing the Number of Employees and Extent of Decimal Knowledge in Use at the Otis Elevator Company.

Chart III. Showing the Number of Employees and Extent of
 Practical Knowledge in Use at the Otis Elevator
 Company.

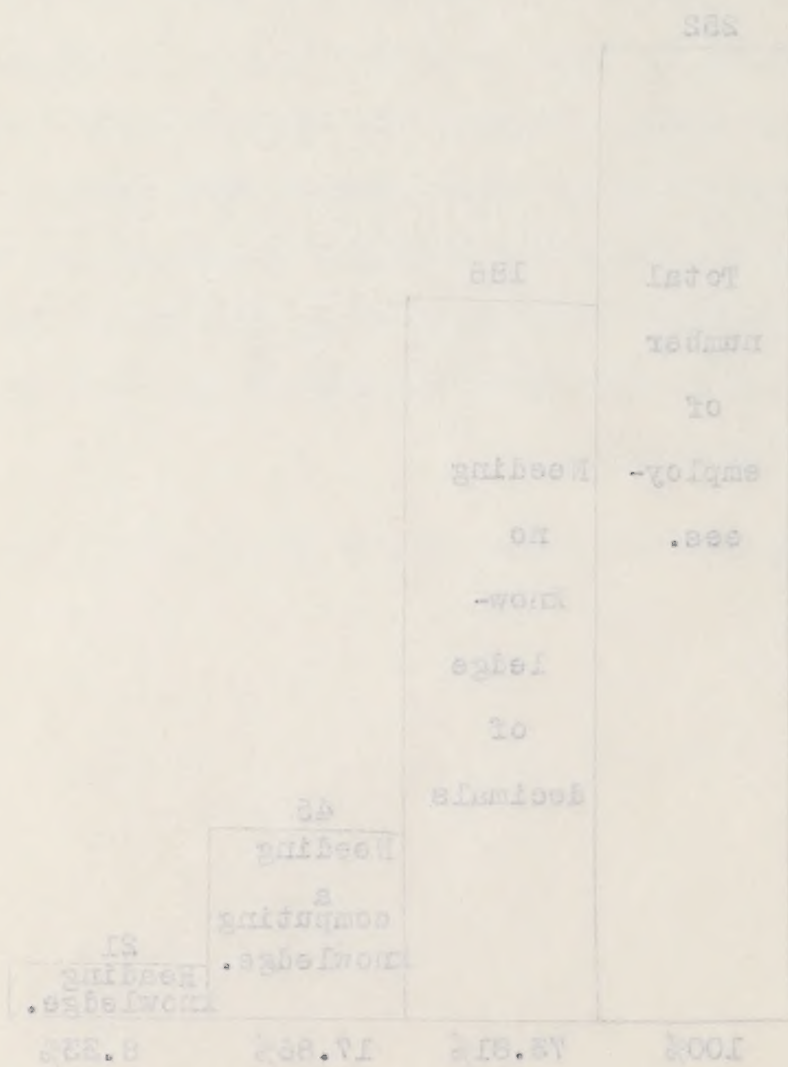


Chart III is to be interpreted as follows; Of the 252 employees at the Otis Elevator Company, 186 or 73.81% of this total do not need any knowledge whatever of decimal usage; 45 employees or 17.86% of the total must have a calculating knowledge of decimals; and 21 or 8.33% need to have a reading knowledge. In no cases do decimals extend beyond five places, and for the most part they are calculated to three or four places. Consequently it may be said without too much reflection that those who are required to possess a computative knowledge of decimals could be instructed in such usage in their mechanical and business training.

Chart III is to be interpreted as follows: Of the 225 employees at the Otis Elevator Company, 186 or 82.6% of this total do not need any knowledge whatever of decimal usage; 45 employees or 19.8% of the total must have a calculating knowledge of decimals; and 21 or 9.3% need to have a working knowledge. In no cases do decimals extend beyond five places, and for the most part they are calculated to three or four places. Consequently it may be said without too much reflection that those who are required to possess a computational knowledge of decimals could be instructed in such usage in their mechanical and business training.

The Devonshire Financial Service Corporation, located at 344 Commonwealth Avenue, Boston, is a subsidiary company of the National Investment Bank of Boston. This corporation is organized to finance installment paper originating from the sale of automobiles, refrigerators, oil burners, radio equipment, dental and X-ray equipment, heavy duty machinery and other miscellaneous items. The income of this corporation is realized solely from the finance charges paid by customers who purchase any of the above listed equipment on credit, and who take advantage of a plan in which new equipment is sold on a definite period of time, such charges are determined as a result of certain

4. DEVONSHIRE FINANCIAL SERVICE CORPORATION

The actual figuring of amounts, however, has for the most part been eliminated. Instead, rate charts are employed on which are recorded the necessary information concerning each percentage figures as used to be made by the persons using these charts. Declines are extended to six places on some of these charts but they ultimately become reduced to two places, rounding the dollars and cents value.

The writer made a number of visits to this company during the first two years of March, 1936, and was cordially received on each occasion by Messrs. J. J. Corbett and T. J. Neefe, assistant credit manager and industrial sales manager, respectively. During one of the interviews Mr. Corbett explained how the Federal Housing Film operates. The latter feels that the

4. DEVONSHIRE FINANCIAL SERVICE CORPORATION

The Devonshire Financial Service Corporation, located at 544 Commonwealth Avenue, Boston, is a subsidiary company of the National Shawmut Bank of Boston. This corporation is organized to finance installment paper originating from the sale of automobiles, refrigerators, oil burners, dairy equipment, dental and x-ray equipment, heavy duty machinery and other miscellaneous items. The income of this corporation is realized solely from the finance charges paid by customers who purchase any of the above named equipment on credit, and who take advantage of a plan to finance such equipment over a certain period of time. Such charges are determined as a result of certain interest, discount and percentage calculations. The actual figuring of decimals, however, has for the most part been eliminated. Instead, rate charts are employed on which are recorded the necessary information concerning such percentage figures as need to be known by the persons using these charts. Decimals are extended to six places on some of these charts but they ultimately become reduced to two places, showing the dollars and cents value.

The writer made a number of visits to this concern during the first two weeks of March, 1935, and was cordially received on each occasion by Messrs. W.J. Corbett and T.P. Keefe, assistant credit manager and industrial sales manager, respectively. During one of the interviews Mr. Corbett explained just how the Federal Housing Plan operates. The author feels that this

The Department of Finance Corporation, located at 222 Commonwealth Avenue, Boston, is a subsidiary company of the National Bank of Boston. This corporation is organized to finance installment paper originating from the sale of automobiles, refrigerators, oil burners, dairy equipment, heated and x-ray equipment, heavy duty machinery and other miscellaneous items. The income of this corporation is realized solely from the finance charges paid by customers who purchase any of the above named equipment on credit, and who take advantage of a plan to finance each equipment over a certain period of time. Such charges are determined as a result of certain interest, discount and percentage calculations. The actual figuring of decimals, however, has for the most part been eliminated. Instead, rate charts are employed on which are recorded the necessary information concerning each percentage figures as used to be known by the persons making these charts. Decimals are extended to six places on some of these charts but they ultimately become reduced to two places, showing the dollars and cents value.

The writer made a number of visits to this concern during the first two weeks of March, 1935, and was considerably impressed on each occasion by Messrs. W.J. Corbett and T.V. Keefe, assistant credit manager and industrial sales manager, respectively. During one of the interviews Mr. Corbett explained that how the Federal Reserve Bank operates. The author feels that this

plan should be illustrated in his paper inasmuch as the company under investigation employs the plan extensively in business dealings. In the following exemplified portion, reference is made to the Modernization Credit Plan¹ and below are given factors which may be used to facilitate the handling of notes under the plan. In the center column are figures from 12 to 36 for each possible monthly maturity that may be used for such a note. In the right hand column are discount factors. The face amount of a discount note multiplied by the discount factor for any maturity desired will give the maximum permissible amount of discount that may be collected. In the left hand column are gross charge factors. The amount of cash proceeds desired - the principal sum the borrower wants- multiplied by the gross charge factor for any maturity will give the maximum permissible amount of interest and/or fee that may be collected.

Illustrations of the discount factor and the gross charge factors follow:

How to Use the Discount Factor

Discount of \$5.00 on a \$100.00 note for a period of one year with provision in the note for monthly installments to be paid gives a ratio of .097166, between gross income and average outstanding balances of the institution's funds during the period of the loan. This is the maximum return under the regulations of the Federal Housing Administration that any finan-

¹Copied from Form 14---Federal Housing Administration Plan.

plan should be illustrated in his paper inasmuch as the company under investigation employs the plan extensively in business dealings. In the following exemplified portion, reference is made to the Robertson Credit Plan and below are given factors which may be used to facilitate the handling of notes under the plan. In the center column are figures from 12 to 36 for each possible monthly maturity that may be used for each note. In the right hand column are discount factors. The face amount of a discount note multiplied by the discount factor for any maturity desired will give the maximum permissible amount of discount that may be collected. In the left hand column are gross charge factors. The amount of cash proceeds desired - the principal sum the borrower wants - multiplied by the gross charge factor for any maturity will give the maximum permissible amount of interest and/or fee that may be collected.

Illustrations of the discount factor and the gross charge

factors follow:

How to Use the Discount Factor

Discount of \$5.00 on a \$100.00 note for a period of one year with provision in the note for monthly installments to be paid gives a ratio of .05163. Between gross income and average outstanding balance of the institution's funds during the period of the loan. This is the maximum return under the regulations of the Federal Housing Administration that any financial

cial institution may obtain on a note of any size, of any maturity, and regardless of the number of installment payments. (The same limit would apply to a note providing for one installment a year as to one providing twelve installments.)

On a one-year note, of course, the discount factor is .05. On a 15 months note, however, the discount factor is .060837; on a 24 months note, .091912; 36 months note, .130282. The discount factor for each maturity from 12 to 36 months is given in the accompanying table. On a discount note of \$1,000. face amount, the amount of discount for 12 months would be \$50.00; for 15 months, \$60.84; for 24 months, \$91.91; for 36 months, \$130.28.

How to Use The Gross Factor Charge

A financial institution, desiring to use an interest bearing note, with or without a fee, or for any reason to ascertain the maximum amount of interest and/or fees it would be permissible to take on any principal sum which a borrower needs for property modernization in order not to exceed the ratio of .097166 between gross income and average outstanding balances of the institution's funds during the period of the loan, can do so by using the gross charge factor. Thus on a one-year note the gross charge factor is .052632; on a fifteen months note it is .064778; on a twenty-four months note, .101215; on a thirty-six months note, .149798. The gross charge factor for each maturity from 12 to 36 months is also given on the accompanying table. Thus by taking a \$950 amount and multi-

cial institution may obtain on a note of any size, of any mat-
urity, and regardless of the number of installment payments.
(The same limit would apply to a note providing for one in-
stallment a year as to one providing twelve installments.)
On a one-year note, of course, the discount factor is .95.
On a 12 months note, however, the discount factor is .950237;
on a 24 months note, .951912; 36 months note, .953222. The
discount factor for each maturity from 12 to 36 months is
given in the accompanying table. On a discount note of \$1,000,
these amounts, the amount of discount for 12 months would be
\$50.00; for 18 months, \$50.84; for 24 months, \$51.91; for 36
months, \$53.68.

How to Use the Gross Factor Charge

A financial institution, desiring to use an interest bear-
ing note, with or without a fee, or for any reason to ascertain
the maximum amount of interest and/or fees it would be permit-
ted to take on any principal sum which a borrower needs for
property mortgaged in order not to exceed the ratio of
.9912 between gross income and average outstanding balances
of the institution's loans during the period of the loan, can
do so by using the gross charge factor. Thus on a one-year
note the gross charge factor is .953222; on a fifteen months
note it is .954778; on a twenty-four months note, .958112; on
a thirty-six months note, .963793. The gross charge factor
for each maturity from 12 to 36 months is also given on the
accompanying table. Thus by taking a \$950 amount and multi-

plying by the proper gross charge factor the amount of interest and/or fee allowed for 12 months will prove to be \$50; for 15 months, \$61.54; for 24 months, \$96.15; for 36 months, \$142.31.

On the succeeding page is a table of calculations prepared by the Federal Housing Administration for the purpose of providing information to financial companies and relating to maximum permissible charges on notes covering property modernization credits.

paying by the proper gross charge factor the amount of interest and/or fee allowed for 12 months will prove to be \$20; for 18 months, \$31.64; for 24 months, \$46.15; for 30 months, \$62.31.

On the succeeding page is a table of calculations prepared by the Federal Housing Administration for the purpose of providing information to financial companies and relating to maximum permissible charges on notes covering property modernization credits.

VIII. Table of Calculations Prepared by the Federal Housing Administration for the Information of Financial Institutions Relating to Maximum Permissible Charges on Notes Covering Property Modernization Credits.

Gross Charge Factor (Based on \$1 of proceeds)	Number of monthly in- stallments in which loan is to be repaid	Discount factor (Based on \$1 of loan amount)
.052632	12	.050000
.056680	13	.053640
.060729	14	.057252
.064778	15	.060837
.068826	16	.064394
.072875	17	.067925
.076924	18	.071429
.080971	19	.074906
.085020	20	.078358
.089068	21	.081784
.093117	22	.085185
.097166	23	.088561
.101215	24	.091912
.105263	25	.095238
.109312	26	.098540
.113360	27	.101818
.117408	28	.105072
.121457	29	.108303
.125506	30	.111511
.129554	31	.114695
.133603	32	.117857
.137651	33	.120996
.141700	34	.124113
.145748	35	.127208
.149798	36	.130282

VIII. Table of Calculations Prepared by the Federal Housing
 Administration for the Information of Financial Insti-
 tutions Relating to Maximum Permissible Charges on Mort-
 gages Covering Property Investment Credits.

Gross Charge Factor (Based on 1% of proceeds)	Number of monthly in- stallments in which loan is to be repaid	Discount Factor (Based on 1% of loan amount)
.055533	12	.950000
.055580	13	.953540
.055723	14	.957252
.055873	15	.960837
.056025	16	.964394
.056178	17	.967923
.056324	18	.971423
.056471	19	.974903
.056620	20	.978353
.056768	21	.981784
.056917	22	.985193
.057066	23	.988581
.057215	24	.991948
.057363	25	.995293
.057512	26	.998613
.057660	27	.101918
.057808	28	.105207
.057956	29	.108480
.058103	30	.111737
.058250	31	.114978
.058396	32	.118203
.058542	33	.121412
.058687	34	.124605
.058832	35	.127782
.058976	36	.130943
.059120	37	.134088
.059263	38	.137217
.059406	39	.140330
.059548	40	.143427
.059690	41	.146508
.059831	42	.149573
.059972	43	.152622
.060112	44	.155655
.060252	45	.158672
.060391	46	.161673
.060530	47	.164658
.060668	48	.167627
.060806	49	.170580
.060943	50	.173517
.061079	51	.176438
.061215	52	.179343
.061350	53	.182232
.061484	54	.185105
.061618	55	.187962
.061751	56	.190803
.061884	57	.193628
.062016	58	.196437
.062148	59	.199230
.062279	60	.202007
.062410	61	.204768
.062540	62	.207513
.062670	63	.210242
.062800	64	.212955
.062929	65	.215652
.063058	66	.218333
.063186	67	.221000
.063314	68	.223652
.063441	69	.226289
.063568	70	.228911
.063694	71	.231518
.063820	72	.234110
.063945	73	.236687
.064070	74	.239249
.064194	75	.241795
.064318	76	.244326
.064441	77	.246841
.064564	78	.249341
.064686	79	.251826
.064808	80	.254295
.064929	81	.256749
.065050	82	.259188
.065171	83	.261612
.065291	84	.264021
.065411	85	.266415
.065531	86	.268794
.065650	87	.271158
.065769	88	.273507
.065888	89	.275841
.066006	90	.278160
.066124	91	.280464
.066242	92	.282753
.066359	93	.285027
.066476	94	.287286
.066593	95	.289530
.066709	96	.291759
.066825	97	.293973
.066941	98	.296172
.067056	99	.298356
.067171	100	.300525

In reference to the author's investigation at the Devonshire Financial Service Corporation the following data was collected:

The entire personnel is composed of one hundred and nine persons who are segregated into four distinct departments, namely, sales, industrial, motor, and general office. In the sales department there are eleven employees. The men of this department visit concerns dealing in various types of machine equipment, and explain to these dealers financing plans of the corporation, endeavoring to purchase these dealer's outstanding accounts receivable. A dealer making a sale of any of the previously mentioned equipment to a customer whose credit rating meets with the approval of the financial corporation is able to discount the credit paper with the finance company who generally pays to the dealer the full cash value of such equipment sold on credit. Under such a plan the following benefits are received: (1) the dealer receives cash for the equipment sold on credit; (2) the dealer, instead of keeping his capital tied up in credit accounts can operate his business on a larger scale; and, (3) the dealer's time is saved in the matter of collecting outstanding accounts.

Although, in most cases, the dealer endorses the installment paper sold by him with recourse to himself, yet it has been proved over a long period of time that his percentage of loss on bad accounts is less than $\frac{1}{2}\%$, because if equipment is repossessed, the delinquent debtor can be sued for any deficiency

In reference to the author's investigation at the Devon-

shire Financial Service Corporation the following data was

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credit accounts can operate his business on a larger scale; and

(3) the dealer's time is saved in the matter of collecting

outstanding accounts.

Although, in most cases, the dealer endorses the instal-

ment paper sold by him with recourse to himself, yet it has been

proved over a long period of time that his percentage of loss

on bad accounts is less than 1%. Because if equipment is re-

possessed, the delinquent dealer can be sued for any delinquency

growing out of the resale of the article.

In this type of work the salesmen are required to have a reading knowledge of decimals. They utilize and make reference to rate charts on which are recorded percentages for finance charges. In addition the charts show the actual amounts of installments which include the principal and financial charges in dollars and cents value. The salesmen, then, do not need to compute decimals; in fact it would not be practical for them to do so, because by having rate charts at their command they are not only able to save time in calculations but any possible error that might result from such calculations are thus eliminated.

In the industrial department there are eight employees, three of whom need a calculating knowledge of decimals. These persons figure special rates and percentages on certain items to which the rate chart cannot be applied, that is, items that are financed for dealers over a short period of time such as thirty, sixty, or ninety days. Most of the decimals thus determined are of four place figures although in some cases they do extend to five places. There are also two members in this department who need to possess a reading knowledge of decimals for the purpose of explaining the uses of the rate charts to those people who inquire about them.

The motor division is sub-divided into the wholesale department and the credit and collection department. In the wholesale department there are thirteen employees, one of whom

growing out of the results of the article.

In this type of work the salesmen are required to have a working knowledge of decimals. They utilize and make reference to rate charts on which are recorded percentages for the same charges. In addition the charts show the actual amounts of instalments which include the principal and financial charges in dollars and cents value. The salesmen, then, do not need to compute decimals; in fact it would not be practical for them to do so, because by having rate charts at their command they are not only able to save time in calculations but any possible error that might result from such calculations are thus eliminated.

In the industrial department there are eight employees, three of whom need a calculating knowledge of decimals. These persons figure special rates and percentages on certain items to which the rate chart cannot be applied, that is, items that are financed for longer over a short period of time than six, thirty, sixty, or ninety days. Most of the decimals that are determined are of four place figures although in some cases they extend to five places. There are also two members in this department who need to possess a working knowledge of decimals for the purpose of explaining the uses of the rate charts to those people who inquire about them.

The motor division is sub-divided into the wholesale department and the credit and collection department. In the wholesale department there are thirteen employees, one of whom

calculates decimals in form of interest charges on each dealer's account balance. The manager of the department needs a reading knowledge for explanatory purposes to dealers.

There are sixteen employees in the credit department. The work of this department involves investigating the credit ability of prospective purchasers who are contemplating buying a certain piece of equipment. No decimal knowledge is necessary in such work.

In the general office there are sixty-one employees. The duties to be performed by various members of this department include the handling of discounts for all automobile installment paper and the performance of bookkeeping detail and miscellaneous office routine. Ten persons need a computative knowledge of decimals to figure discounts, rebates, and insurance charges against collision and conversion. Such calculations are confined to three places. For example, in computing a rebate, the first operation is that of determining the number of days the insurance policy has been in force. When this has been done reference is made to the pro rata premium table to determine the unearned or earned portion of the insurance premium. The following is an illustration:

Premium from January 1 to March 14-----	\$10.33
Actual number of days in force-----	72
Return premium-----	.803 times \$10.33
	or \$8.29

(The decimal .803 is found in the pro rata premium table under the heading of "Return in Percentage of Premium")

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The following list of interest charges was made to dealers in order to encourage them to display stocks on their floors during the months of January and February of 1935. These tabulations show interest charges to be paid, depending on date and length of trust receipt. The tabulations thus recorded appear in Table IX on the following page. In such a case the finance company pays the manufacturers for the equipment and charges the dealer the proportionate rate of interest for the time the equipment remains unsold.

1		.0000	.0000
2		.0000	.0000
3		.0000	.0000
4		.0000	.0000
5		.0000	.0000
6		.0000	.0000
7		.0000	.0000
8		.0000	.0000
9		.0000	.0000
10		.0000	.0000
11		.0000	.0000
12		.0000	.0000
13		.0000	.0000
14		.0000	.0000
15		.0000	.0000
16		.0000	.0000
17		.0000	.0000
18		.0000	.0000
19		.0000	.0000
20		.0000	.0000
21		.0000	.0000
22		.0000	.0000
23		.0000	.0000
24		.0000	.0000
25		.0000	.0000
26		.0000	.0000
27		.0000	.0000
28		.0000	.0000
29		.0000	.0000
30		.0000	.0000
31		.0000	.0000

The following list of interest charges was made to dealers

in order to encourage them to display stocks on their floors during the months of January and February of 1933. These tabulations show interest charges to be paid, depending on date and length of trust receipt. The tabulations thus recorded appear in Table IX on the following page. In such a case the finance company pays the manufacturers for the equipment and charges the dealer the proportionate rate of interest for the time the equipment remains unsold.

IX. Table showing Special Interest Charges Made to Dealers
For the Months of January and February, 1935.

INTEREST CHARGE TO DEALERS ON TRUST RECEIPT FOR:

	30 Days	60 Days	90 Days
Jan 2 -		.0333%	.5333%
3 -		.0500	.5500
4 -		.0667	.5667
5 -		.0833	.5833
6 -		.1000	.6000
7 -		.1167	.6167
8 -		.1333	.6333
9 -		.1500	.6500
10 -		.1667	.6667
11 -		.1883	.6833
12 -		.2000	.7000
13 -		.2167	.7167
14 -		.2333	.7333
15 -		.2500	.7500
16 -		.2667	.7667
17 -		.2833	.7833
18 -		.3000	.8000
19 -		.3167	.8167
20 -		.3333	.8333
22 -		.3500	.8500
23 -		.3667	.8667
24 -		.3833	.8833
25 -		.4000	.9000
26 -		.4167	.9167
27 -		.4333	.9333
28 -		.4500	.9500
29 -		.4667	.9667
30 -		.4833	.9833
31 -		.5000	1.0000

(Table IX---continued)

	30 Days	60 Days	90 days
Feb 1	.0333	.5333	1.0333
2	.0500	.5500	1.0500
3	.0667	.5667	1.0667
4	.0833	.5833	1.0833
5	.1000	.6000	1.1000
6	.1167	.6167	1.1167
7	.1333	.6333	1.1333
8	.1500	.6500	1.1500
9	.1667	.6667	1.1667
10	.1833	.6833	1.1833
11	.2000	.7000	1.2000
12	.2167	.7167	1.2167
13	.2333	.7333	1.2333
14	.2500	.7500	1.2500
15	.2667	.7667	1.2667
16	.2833	.7833	1.2833
17	.3000	.8000	1.3000
18	.3167	.8167	1.3167
19	.3333	.8333	1.3333
20	.3500	.8500	1.3500
21	.3667	.8667	1.3667
22	.3833	.8833	1.3833
23	.4000	.9000	1.4000
24	.4167	.9167	1.4167
25	.4333	.9333	1.4333
26	.4500	.9500	1.4500
27	.4667	.9667	1.4667
28	.4833	.9833	1.4833
29	.5000	1.0000	1.5000

A summary of the data collected at the Devonshire Financial Service Corporation appears in condensed form in Table X on the next page.

Table Showing the Personnel and Nature of Technical Knowledge possessed at the Devonshire Financial Service Corp.

Split-up of personnel of technical knowledge	No. possessing no knowledge or rudimentary knowledge	No. possessing complete knowledge	No. possessing incomplete knowledge	Sample	Totals
Sales		11		.45	11
Industrial	5	2	3	.0033	6
Motor					
(a) Wholesale	11	1	1	.35	13
(b) Collection	15				15
General office	51		10	.715	61
Totals	51	14	14		109

A summary of the data collected at the Devonshire House
trial Service Corporation appears in condensed form in Table I
on the next page.

X. Table Showing the Personnel and Amount of Decimal Knowledge Needed at the Devonshire Financial Service Corp.

Split-up of personnel	No. needing no knowledge of decimals	No. needing a reading knowledge	No. who compute decimals	Sample decimal	Totals
Sales	3	11		.07	11
Industrial	3	2	3	.0333	8
Motor					
(a) Wholesale	11	1	1	.06	13
Credit &					
(b) Collection	16				16
General Office	51		10	.716	61
Totals	81	14	14		109

Table X is partially self-explanatory. Of the one hundred and nine persons employed at the Devonshire Financial Service Corporation three persons in the industrial department, eleven in the wholesale department, sixteen in the credit and collection department and fifty-one in the general office are not required to have a decimal knowledge in any form whatever. This number represents 74.31% of the total. Those requiring a reading knowledge of decimals are eleven of the sales group, two in the industrial department and one in the wholesale department, or 12.84% of the total. There are three employees in the industrial department, one in the wholesale department, and ten in the office, or a group representing 12.84% of the entire personnel who need a computative knowledge of decimals in their daily work.

These groupings are summarized in Chart IV .

Table I is partially self-explanatory. Of the one hundred and nine persons employed at the Government Statistical Service Corporation three persons in the industrial department, eleven in the wholesale department, sixteen in the credit and collection department and fifty-one in the general office are not required to have a decimal knowledge in any form whatever. This number represents 74.31 of the total. Those requiring a reading knowledge of decimals are eleven of the sales group, two in the industrial department and one in the wholesale department, or 12.84 of the total. There are three employees in the industrial department, one in the wholesale department and ten in the office, or a group representing 13.84 of the entire personnel who need a comprehensive knowledge of decimals in their daily work.

These groupings are summarized in Chart IV.

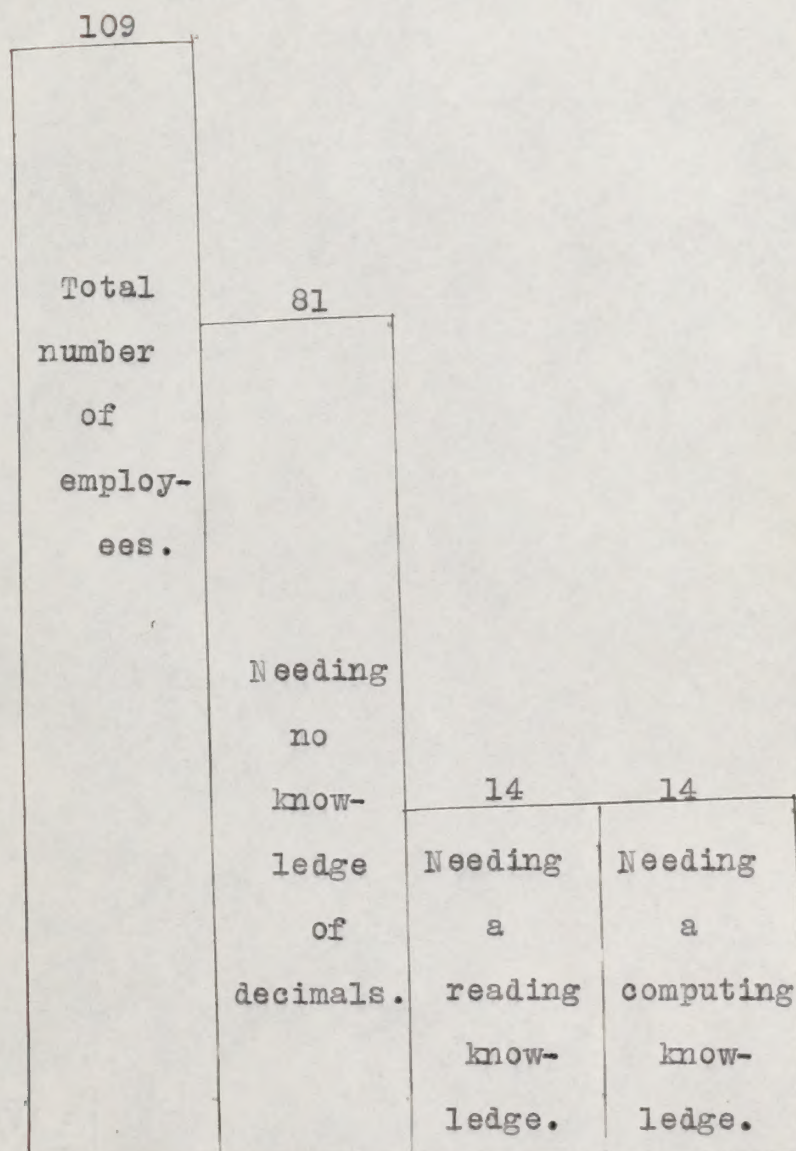


Chart IV. Showing the Number of Employees and Extent of Decimal Knowledge in Use at the Devonshire Financial Service Corporation.

Chart IV. Showing the Number of Employees and Extent of
 Decimal Knowledge in Use at the Devonshire
 Financial Service Corporation.

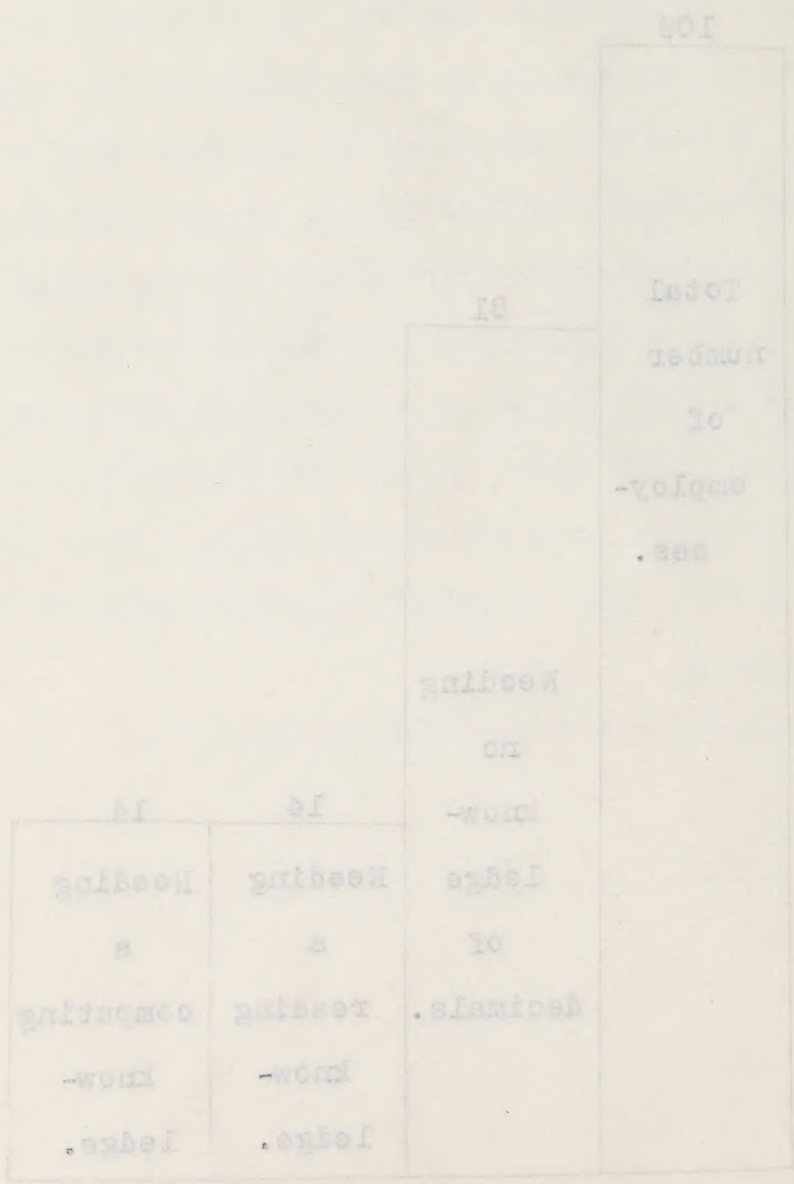


Chart IV is to be interpreted as follows:

Of the 109 persons employed at the Devonshire Financial Service Corporation, 81 or 74.31% of the total need no knowledge of decimals; a reading knowledge is required of 14 employees, representing 12.84%; and 14 or 12.84% need a computing knowledge. Although some of the rate charts used in this concern employ decimal extendings to six places, they are reduced to four or fewer places by those interpreting the readings on them. Those that actually calculate decimals do not carry out their work beyond four places, because for all practical purposes their computations are accurate enough when four places are determined in their reckonings. Therefore, it is logical to assume that instruction in decimal usage may very well be included in these persons' business education and training.

5. BURROUGHS ADDING MACHINE COMPANY

3. REPRODUCTION OF THE ORIGINAL DOCUMENT

The Burroughs Adding Machine Company maintains branches in all the principle cities of the world. For research purposes the author investigated the Boston agency which is located at 136 Federal Street, from which branch all types of modern office appliances are sold. The more important types of office machines sold by this company include adding machines, typewriters, bookkeeping machines, calculators, check-writing machines, addressographs, cash machines, and cash registers. In addition to office equipment the Burroughs company also sells office supplies, which, for the most part consist of office stationery, envelopes, typewriter ribbons, carbon paper, and office chairs.

During a visit to this concern on March 26, 1935, interviews given by Messrs. D. M. Ferguson and C. D. Hurd, agency manager and office manager, respectively, proved to be of no little value to the writer in his study. As a result of these interviews the following were noted to be true:

The total number of employees at the Burroughs Adding Machine Company consists of one hundred and five members distributed among three departments, namely, sales, service, and office. The sales department contains thirty men all of whom come under the supervision of the agency manager. These men sell office appliances only; they have nothing to do with the sales of supplies which is entirely in the hands of the service department. Everyone in the sales department must have a work-

The Burroughs Adding Machine Company maintains branches in all the principal cities of the world. For research purposes the author investigated the Boston agency which is located at 133 Federal Street, from which branch all types of modern office appliances are sold. The more important types of office machines sold by this company include adding machines, typewriters, bookkeeping machines, calculators, check-writing machines, addressographs, cash machines, and cash registers. In addition to office equipment the Burroughs company also sells office supplies, which for the most part consist of office stationery, envelopes, typewriter ribbons, carbon paper, and office chairs.

During a visit to this concern on March 22, 1933, interviews given by Messrs. D. W. Ferguson and G. D. Ward, agency manager and office manager, respectively, proved to be of no little value to the writer in his study. As a result of these interviews the following were noted to be true:

The total number of employees at the Burroughs Adding Machine Company consists of one hundred and five members distributed among three departments, namely, sales, service, and office. The sales department contains thirty men all of whom come under the supervision of the agency manager. These men sell office appliances only; they have nothing to do with the sales of supplies which is entirely in the hands of the service department. Everyone in the sales department must have a work-

ing knowledge of decimals. "But", as Mister Ferguson remarked, "unlike others who probably use decimals for certain fixed operations, my men must use them in any and every occasion. You see, in this business, we are always dealing with numbers of one sort or another. For instance, if one of my men is contacting a prospect in the lumber business it is certain that the term 'board feet' will be mentioned, and that is figured in decimals. Or suppose that another salesman is trying to sell a machine to a leather merchant. It will be necessary to know something about leather accounting. Then, too, the processes of addition, subtraction, multiplication and division of decimals are included in our demonstrations." Mr. Ferguson further added: "As a matter of fact we give each applicant for sales work a test in arithmetic, and, naturally, we include decimals in some of the problems. If the applicant cannot pass this arithmetic examination, he cannot hope to be accepted as a member of our sales organization."

It is quite evident from these facts that there is no fixed line of demarcation in the salesmens' usages for decimals, because the members of the sales force must be prepared to employ decimals at any time when dealing with prospects. However, it is seldom that calculations beyond four places are ever made.

There are fifty-eight people in the service department. Only one member, the service manager must be acquainted with decimals, and that to the extent of a reading knowledge, in

the knowledge of decimals. "But", as Master Ferguson remarks, "while others who probably use decimals for certain fixed occasions, we men must use them in any and every occasion. For see, in this business, we are always dealing with numbers of one sort or another. For instance, if one of my men is conducting a prospect in the lumber business it is certain that the term 'board feet' will be mentioned, and that in figuring in decimals. Or suppose that another salesman is trying to sell a machine to a lumber merchant. It will be necessary to know something about factory accounting. Then, too, the processes of addition, subtraction, multiplication and division of decimals are included in our demonstrations." Mr. Ferguson further added: "as a matter of fact we give such applicants for sales work a test in arithmetic, and, naturally, we include decimals in some of the problems. If the applicant cannot pass this arithmetic examination, he cannot hope to be accepted as a member of our sales organization."

It is quite evident from these facts that there is no fixed time of demonstration in the salesman's usage for decimals because the masters of the sales force must be prepared to supply decimals at any time when dealing with prospects. However, it is seldom that calculations beyond four figures are ever made. There are fifty-eight people in the service department, only one member, the service manager must be acquainted with decimals, and that to the extent of a reading knowledge, in

order to interpret the reports sent to him from the office. These decimals never go beyond three places and deal entirely with percentage figures.

The remainder of the service department consists of two shipping clerks, five repair men and fifty inspectors, none of whom need to have any knowledge of decimals at all. The shipping clerks receive and send out goods, and the repair men adjust all defective or damaged machines which are sent in to the branch office. The inspectors, in addition to making periodic inspections and adjustments of all machines in their territories, are expected to sell the office supplies of the company. But they have no occasion to use decimals in this kind of work.

The office department consists of sixteen members, under the direction of the office manager. A consignment clerk, who keeps record of the movement of all the stock delivered to the Boston branch, figures decimals to three places in connection with his consignment reports. The cashier, who handles the cash and who has charge of financial and statistical records, calculates decimals to three places in the form of percentages when preparing statements of earnings and expenses. The office manager requires only a reading knowledge of decimals in the interpretation of such reports as are rendered to him by the consignment clerk and the cashier.

The remainder of the personnel in the office are not required to use decimals in any form in connection with their duties.

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The remainder of the personnel in the office are not required to use decimals in any form in connection with their duties.

There are three stenographers who perform the usual stenographic duties in the matter of taking dictation and typing letters of correspondence; a switchboard operator controls the lines of communication as between departments and outside lines; a book-keeper receives remittances, records cash receipts and keeps the ledger posted; and five service detail employees receive, analyze, check and file reports submitted by service men. None of these duties involves the usage of decimals in any form.

Below will be found some of the decimals observed in the author's study. These figures are expressed in terms of percentages, showing a relationship to sales which is the base, or 100%, and from which all other figures compare in ratio. They follow:

- (1) .286 Percentage of salesmens' commissions.
- (2) .117 percentage of salesmens' other compensations.
- (3) .035 percentage of advertising expenses.
- (4) .183 Percentage of auto expense and depreciation.
- (5) .116 percentage of office salaries.
- (6) .062 percentage of rent, light, and heat.
- (7) .008 percentage of office supplies expense.
- (8) .005 percentage of telephone and telegraph expense.
- (9) .009 percentage of furniture and fixture expense and depreciation.

Table XI contains a condensed summary of the data collected.

There are three stenographers who perform the usual stenographic duties in the matter of taking dictation and typing letters of correspondence; a switchboard operator controls the lines of communication between departments and outside lines; a book-keeper receives remittances, records cash receipts and keeps the ledger book; and five service detail employees receive, analyze, check and file reports submitted by service men. None of these duties involves the usage of decimals in any form.

Below will be found some of the decimals observed in the author's study. These figures are expressed in terms of percentages, showing a relationship to sales which is the base, or 100%, and from which all other figures compare in ratio. They

follow:

- (1) .835 percentage of salesmen's commissions.
- (2) .117 percentage of salesmen's other compensation.
- (3) .035 percentage of advertising expenses.
- (4) .183 percentage of auto expense and depreciation.
- (5) .116 percentage of office salaries.
- (6) .082 percentage of rent, light, and heat.
- (7) .008 percentage of office supplies expense.
- (8) .005 percentage of telephone and telegraph expense.
- (9) .009 percentage of furniture and fixture expense and depreciation.

Table II contains a condensed summary of the data collected.

This is partially self-explanatory. Of the 105 personnel at the Burroughs Adding Machine Company, 31 are in sales, 57 are in service, and 13 are in office. The sales personnel are divided into three groups: a management group, a regular sales group, and a training group. The service personnel are divided into three groups: a management group, a regular service group, and a training group. The office personnel are divided into three groups: a management group, a regular office group, and a training group. The percentages shown in the table represent the proportion of each group within the total personnel. The percentages shown in the table represent the proportion of each group within the total personnel.

XI. Table Showing the Personnel and Amount of Decimal Knowledge Needed at the Burroughs Adding Machine Company.

Split-up of personnel	No. needing no knowledge of decimals	No. needing a reading knowledge	No. who compute decimals	Sample decimal	Totals
Sales			31	.4059	31
Service	57	1		.284	58
Office	13	1	2	.133	16
Totals	70	2	33		105

Table showing the personnel and amount of decimal type-
 legs needed at the Bureau of Printing and Engraving.

Category	Self-up of personnel	No. needed no knowledge of decimal	No. needed a reading knowledge	No. needed no. who compute decimals	Sample Totals
Tables				21	.4032
Services	27	1			.234
Offices	13	1		2	.133
Totals	40	2		23	1.00

Table XI is partially self-explanatory. Of the entire personnel at the Burroughs Adding Machine Company, consisting of one hundred and five employees, thirty salesmen, the agency manager, a consignment clerk, and a cashier calculate decimals to three places in most instances, although occasionally, four places are computed. This number represents 31.43% of the total personnel. The service manager and the office manager, representing 1.90% of the total number, need a reading knowledge of decimals to the extent of three places. Fifty inspectors, five repair men, two shippers, three stenographers, a switchboard operator, a bookkeeper and five service detail employees, or 66.67% of the total number of employees have no occasion whatever to use decimals in the performance of their duties.

These groupings are shown in Chart V.

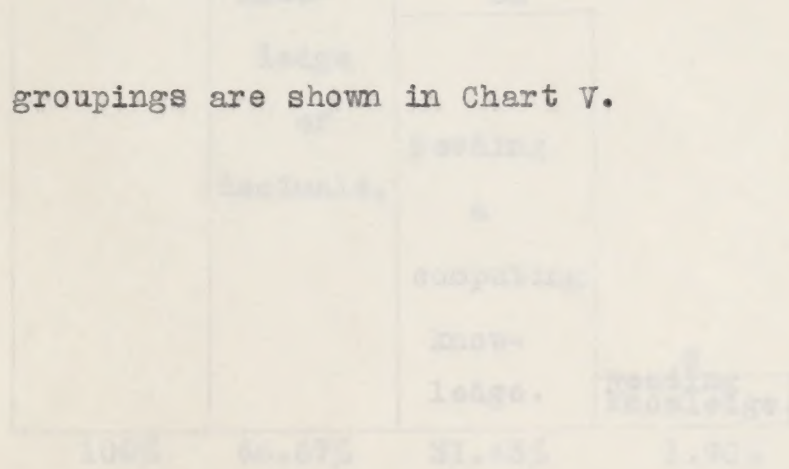


Chart V. Showing the Number of Employees and Extent of Decimal Knowledge in Use at the Burroughs Adding Machine Company.

Table XI is partially self-explanatory. Of the entire personnel at the Burroughs Adding Machine Company, consisting of one hundred and five employees, thirty salaried, the agency manager, a correspondence clerk, and a cashier collect the decimals to three places in most instances, although occasionally, four places are computed. This number represents 51.43% of the total personnel. The service manager and the office manager, representing 1.90% of the total number, need a reading knowledge of decimals to the extent of three places. Fifty inspectors, five repair men, two signers, three stenographers, a switchboard operator, a bookkeeper and five service detail employees, or 66.67% of the total number of employees have no occasion whatever to use decimals in the performance of their duties.

These groupings are shown in Chart V.

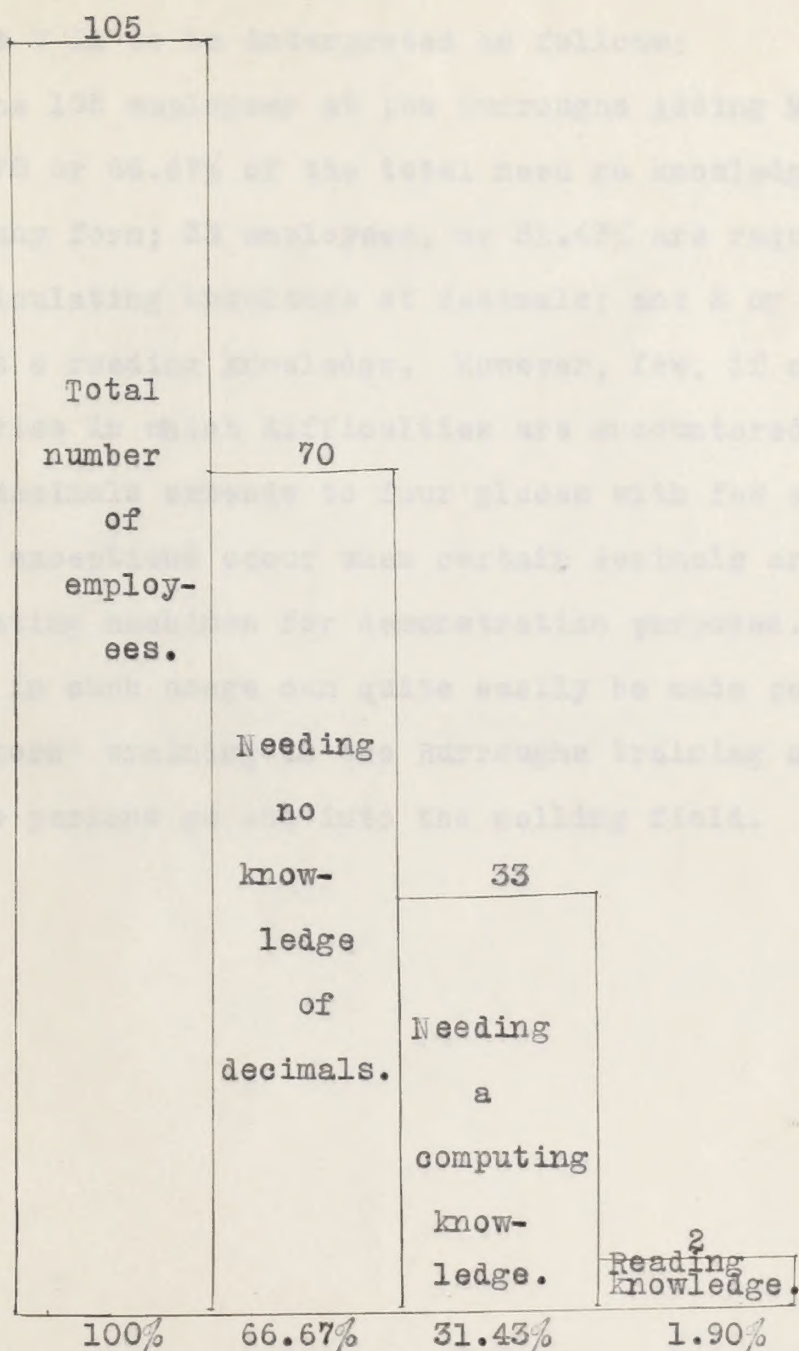


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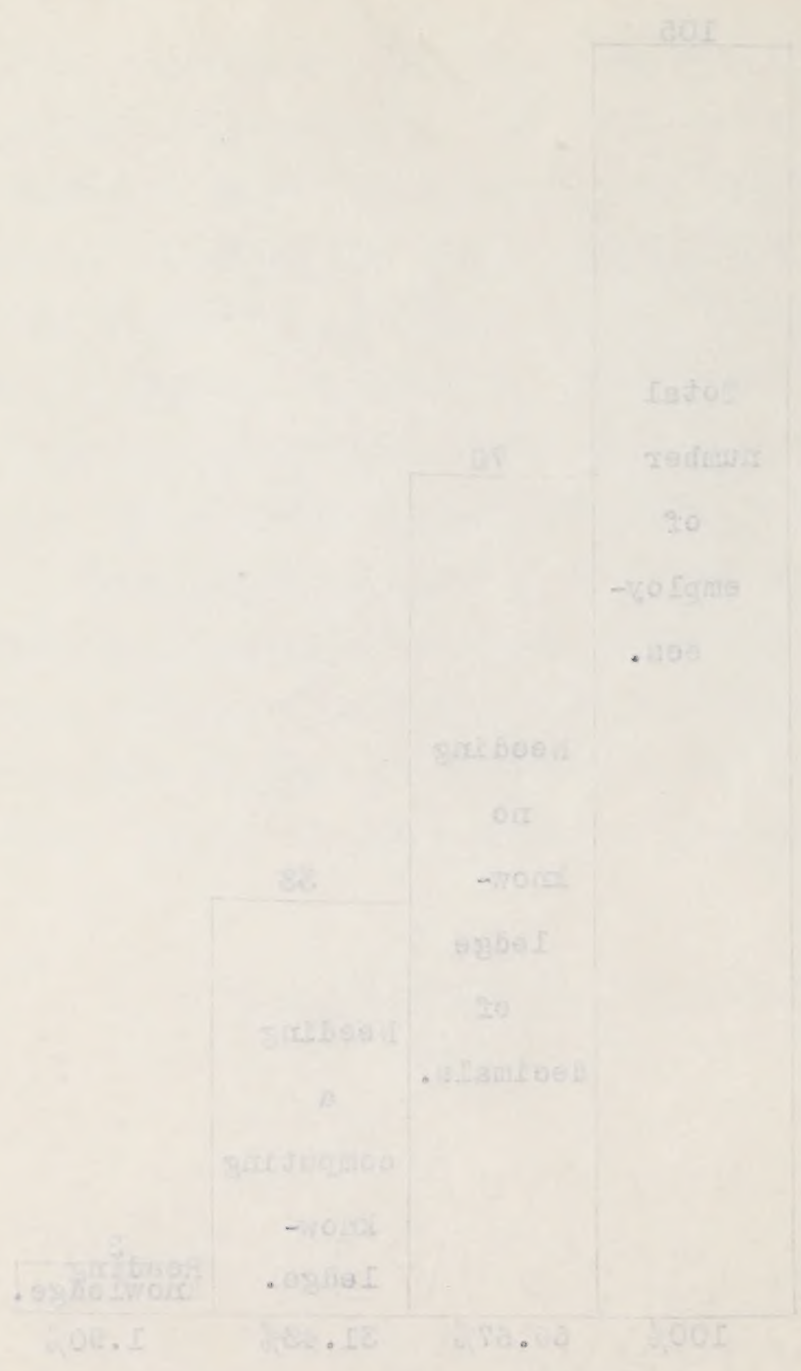


Chart V. Showing the Number of Employees and Extent of Decimal Knowledge in Use at the Burroughs Adding Machine Company.

Chart V is to be interpreted as follows:

Of the 105 employees at the Burroughs Adding Machine Company, 70 or 66.67% of the total need no knowledge of decimals in any form; 33 employees, or 31.43% are required to have a calculating knowledge of decimals; and 2 or 1.90% need to possess a reading knowledge. However, few, if any situations arise in which difficulties are encountered. The usage of decimals extends to four places with few exceptions, and these exceptions occur when certain decimals are computed on calculating machines for demonstration purposes. But instruction in such usage can quite easily be made part of the demonstrators' training in the Burroughs training school before those persons go out into the selling field.

Chart V is to be interpreted as follows:

Of the 105 employees at the Burroughs Adding Machine Company, 70 or 66.67% of the total need no knowledge of decimals in any form; 33 employees, or 31.43%, are reported to have a calculating knowledge of decimals; and 2 or 1.90% need to possess a reading knowledge. However, few, if any situations arise in which difficulties are encountered. The usage of decimals extends to four places with few exceptions, and these exceptions occur when certain decimals are computed on calculating machines for demonstration purposes. But instruction in such usage can quite easily be made part of the demonstrators' training in the Burroughs training school before these persons go out into the selling field.

United Drug Inc.	United Drug Co.	Liggett Drug Co. Inc.
Louis C. Liggett (pres.)	Louis K. Liggett (pres.)	E.M. Gales (pres.)
Holding Company	Operating and Holding Company	

The West- port Phar- ma- ceut- ical Corp.	Valley Phar- ma- ceut- ical Corp.	The Abbe- ott Phar- ma- ceut- ical Corp.	United Drug Co. Ltd. (Gr. Britain) M.D. Vertala Managing Director	Sta- gell Drug Co. of Rich.	Lig- gett Drug Co. of Ill.	The May Drug Co.
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6. UNITED DRUG INCORPORATED

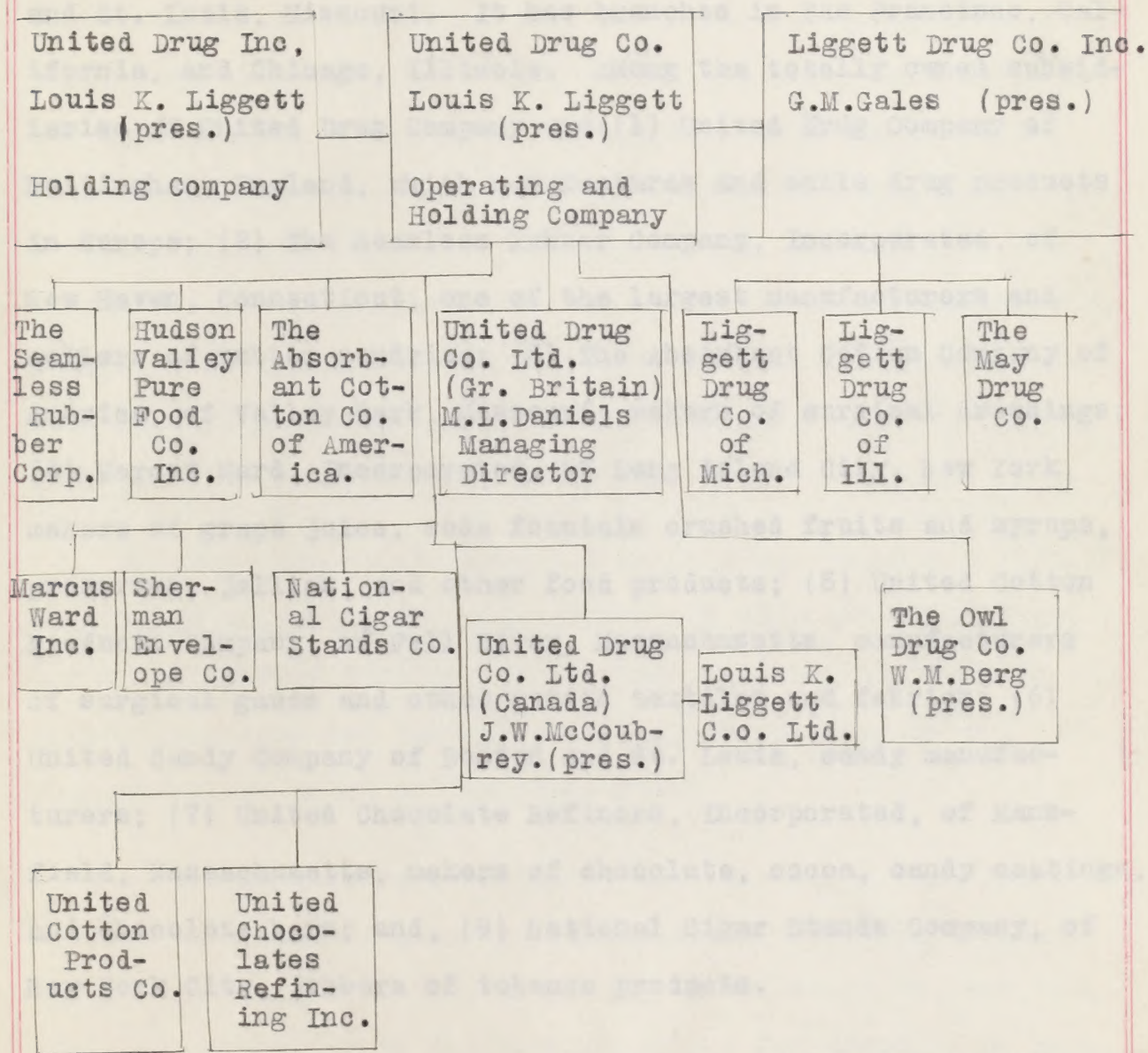
Carson Phar- ma- ceut- ical Corp.	Shor- man Phar- ma- ceut- ical Corp.	Nation- al Cigar Company	United Drug Co. Ltd. (Canada) J.B. McCoub- rey (pres.)	Louis K. Liggett E.M. Gales	The Owl Drug Co. E.M. Gales (pres.)
--	--	--------------------------------	--	-----------------------------------	--

United Cocoa Prod- ucts Co.	United Choco- lates Corpor- ation Inc.
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Organization Chart Showing Manufacturing and Distributing
Companies Affiliated With United Drug, Incorporated.

Taken from the United Drug Incorporated Quarterly Statement
for the period ending March 31, 1936.

..UNITED DRUG LABORATORIES



Organization Chart Showing Manufacturing and Distributing Companies Affiliated With United Drug, Incorporated.

United Drug Company is both a manufacturing and holding company, owning and operating factories at Boston, Massachusetts, and St. Louis, Missouri. It has branches in San Francisco, California, and Chicago, Illinois. Among the totally owned subsidiaries of United Drug Company are: (1) United Drug Company of Nottingham, England, which manufactures and sells drug products in Europe; (2) The Seamless Rubber Company, Incorporated, of New Haven, Connecticut, one of the largest manufacturers and sellers of rubber sundries; (3) The Absorbant Cotton Company of America, of Valley Park, Missouri, makers of surgical dressings; (4) Marcus Ward, Incorporated, of Long Island City, New York, makers of grape juice, soda fountain crushed fruits and syrups, preserves, jellies, and other food products; (5) United Cotton Products Company, of Fall River, Massachusetts, manufacturers of surgical gauze and other cotton textiles and fabrics; (6) United Candy Company of Boston and St. Louis, candy manufacturers; (7) United Chocolate Refiners, Incorporated, of Mansfield, Massachusetts, makers of chocolate, cocoa, candy coatings, and chocolate bars; and, (8) National Cigar Stands Company, of New York City, jobbers of tobacco products.

The products of United Drug Company and its subsidiaries are distributed chiefly through the "Rexall Stores" which are drug stores that are under contract to carry and promote the sales of the products of the United Drug Company in their respective localities.

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retailers of rubber sundries; (3) The Absorbent Cotton Company of America, of Valley Park, Missouri, makers of surgical dressings; (4) Marcus Ward, Incorporated, of Long Island City, New York, makers of grape juice, soda fountain creamed fruits and syrups, preserves, jellies, and other food products; (5) United Cotton Products Company, of Fall River, Massachusetts, manufacturers of surgical gauze and other cotton textiles and fabrics; (6) United Candy Company of Boston and St. Louis, candy manufacturers; (7) United Chocolate Refiners, Incorporated, of New Bedford, Massachusetts, makers of chocolate, cocoa, candy coatings and chocolate bars; and (8) National Cigar Brands Company, of New York City, makers of tobacco products.

The products of United Drug Company and its subsidiaries are distributed chiefly through the "Retail Stores" which are large stores that are under contract to carry and promote the sales of the products of the United Drug Company in their respective localities.

United Drug Company's principal office and Boston factory is located at 27 Leon Street, in the Roxbury section of Boston. It was here that the author carried on his research and he enjoyed many pleasant interviews, during the months of February and March, 1935, with Messrs. Joseph A. Galvin and Harry R. Chandler, treasurer and assistant of the United Drug Company, respectively, and with Miss Mary E. Davies, secretary to the treasurer. These people aided the writer to a considerable extent in his study despite the fact that the research was carried on during a tremendously busy period in which the factory was operating at near capacity speed.

The most important facts are as follows: There are fifteen hundred employees at the laboratories and administration building of the Boston factory. It is here that Rexall products, Shari, Cara Nome and Jonteel toilet goods, and Purest and Pharmaceutical drugs are manufactured.

In the purchasing department there are seven employees, none of whom need to possess a calculating knowledge of decimals. However, a reading knowledge is necessary because decimals are contained in the specifications for goods to be purchased. In view of this fact, interpretations of the percentages of chemical or vitamin content in drugs must be made by the members of this department. However, the decimals encountered do not surpass four figures in length.

The receiving and storage department consists of one

United Drug Company's principal office and Boston factory is located at 27 Essex Street, in the Roxbury section of Boston. It was here that the author carried on his research and he enjoyed many pleasant interviews during the months of February and March, 1935, with Messrs. Joseph A. Selvin and Harry E. Chandler, treasurer and assistant of the United Drug Company, respectively, and with Miss Mary E. Davies, secretary to the treasurer. These people aided the writer to a considerable extent in his study besides the fact that the research was carried on during a tremendously busy period in which the factory was operating at near capacity speed.

The most important facts are as follows: There are fifteen hundred employees at the laboratories and administration building of the Boston factory. It is here that Keweenaw products, such as Keweenaw and Keweenaw toilet goods, and Keweenaw and Keweenaw drugs are manufactured.

In the purchasing department there are seven employees, none of whom need to possess a satisfactory knowledge of English. However, a working knowledge is necessary because the initials are contained in the specifications for goods to be purchased. In view of this fact, interpretation of the present-day use of chemical or vitamin content in drugs must be made by the members of this department. However, the details encountered do not surpass those figures in London.

The receiving and storage department consists of one

hundred and eighty-five employees whose duties entail the receiving, checking, and warehousing of raw materials which are delivered to the factory. None of the members of this group compute decimals, save the warehouse manager who uses them to four places in making out reports involving percentages of costs and expenses in proportion to the wholesale selling prices. Such computations are made monthly, and the findings are recorded on statements which are transferred to the accounting department.

There are seven hundred and sixty members who are employed in the manufacturing department. Only the superintendent and his assistant figure decimals as far as three places to show elements of cost to the sales volume of goods manufactured. For the greatest part, the work of this department consists of drawing upon the raw materials inventory at the warehouse and processing these materials in all stages of operation so as to create the finished products of medicine, either in liquid, powder, pill, or capsule form. The members of this group are not required to engage in any decimal figurings whatsoever. In fact they could carry on their work just as efficiently even if they were totally unaware of the existence of decimals.

The thirty-four members of the analytical and statistical department all use decimals in their daily work. But the results of their computations never carry beyond four places. The most common usage is the determining of the alcoholic content of each manufacturing preparation. The United States

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The thirty-four members of the analytical and statistical department all use decimals in their daily work. But the results of their computations never carry beyond four places. The most common usage is the determining of the alcoholic content of each manufacturing preparation. The United States

Government requires that the alcoholic content embodied in every type of drug and medical preparation be stated on a suitable label or package container. For instance the author observed the following situation. The standard alcoholic content of a certain neutralizing cordial is 3.27%. After analyzing this preparation in bulk form it was determined, in order to satisfy the government requirements and standards, that 6.73 pints of 95% pure grain alcohol had to be added to the preparation. When this amount was added the neutralizer could be properly labelled.

The general duties performed by the members of this department consist of checking all types of preparations for identity, purity, and formula standards. When the analyses are completed the results of such findings are sent to the head of the department in percentage form.

There are eighty members that make up the power, maintenance and auxiliary department. Only one, the construction engineer, who is in charge of the mechanical department, actually figures decimals for the purpose of calculating construction estimates. The decimals used in such computations do not exceed four places in length. The duties of the other employees of this department consist entirely of maintaining general repairs of the buildings, equipment, and power plant. No knowledge of decimals is necessary at all in the performance of such duties.

Government requires that the alcoholic content embodied in every type of drug and medical preparation be stated on a suitable label on package container. For instance the author observed the following situation. The standard alcoholic content of a certain neutralizing cordial is 5.25%. After analyzing this preparation in bulk form it was determined, in order to satisfy the Government's requirements and standards, that 0.93 pints of 95% pure grain alcohol had to be added to the preparation. When this amount was added the neutralizer could be properly labelled.

The general duties performed by the members of this department consist of checking all types of preparations for identity, purity, and formula standards. When the analyses are completed the results of each finding are sent to the head of the department in package form.

There are eight members that make up the power, maintenance and auxiliary department. Only one, the construction engineer, was in charge of the mechanical department, auxiliary figures included for the purpose of calculating construction estimates. The facilities used in such computations do not exceed four places in length. The duties of the other employees of this department consist entirely of maintaining general records of the buildings, equipment, and power plant. The knowledge of details is necessary at all in the performance of such duties.

Comprising the advertising and publicity groups are twenty employees under the charge of the advertising manager. He, alone, needs to be familiar with decimals to the extent of a reading knowledge only for the purpose of interpreting percentages contained in statements sent to him by the accounting department. The work of this department involves the drawing up of advertising displays and pictures, and the compiling of publicity literature. These duties may be performed without any knowledge of decimals.

The sales department is composed of one hundred and thirty-nine members. Of this number, there are one hundred and one field men who need no knowledge of decimals other than a small speaking knowledge to the extent of acquainting the prospect with the percentage of profit that the prospect can realize if he sells the product in question at a certain price. These field men, on the other hand, originate none of the percentages, such computations being the work of the office sales members, who are thirty-eight in number. These men inform the field force of the prices that may be quoted to customers, and the relative percentage of gross profit attained if that customer resells at a certain higher price. In addition, the office salesmen tabulate the work of the field men in relation to quotas, special drives, one-cent sales, and monthly special sales. The actual percentage calculations, all of four place figures refer to quota attainments and gains and losses realized by each district.

comprising the advertising and publicity groups are twenty employees under the charge of the advertising manager. He alone needs to be familiar with accounts to the extent of a passing knowledge only for the purpose of interpreting statements contained in statements sent to him by the accounting department. The work of this department involves the drawing up of advertising displays and photos, and the compiling of publicity literature. These duties may be performed without any knowledge of accounts.

The sales department is composed of one hundred and thirty-nine members. Of this number, there are one hundred and one field men who need no knowledge of accounts other than a small passing knowledge to the extent of recognizing the prospect with the percentage of profit that the prospect can realize if he sells the product in question at a certain price. These field men, on the other hand, originate none of the percentages and computations being the work of the office sales members, who are thirty-eight in number. These men inform the field force of the prices that may be quoted to customers, and the relative percentage of gross profit attained if that customer results at a certain higher price. In addition, the office salesmen tabulate the work of the field men in relation to quotas, special drives, one-cent sales, and monthly special sales. The actual percentage calculations, all of four place figures refer to gross attainments and gains and losses realized by each district.

There are one hundred and twenty-seven members connected with the accounting department, all of whom employ decimals in the form of percentage figures. Such calculations extend to four places and disclose relations between costs, distributions of overhead, and other expenses to the net sales figure which is used as the base for all percentage findings.

The twenty-two employees in the credit department are not concerned with decimals, except the credit manager, who needs a reading knowledge to interpret the four place percentage findings which are included on reports received from the accounting department.

The other clerical employees, including stenographers, mail department clerks, time keepers, and sundry clerks need no knowledge whatever of decimals in order to perform their daily duties.

Illustrations of typical decimals used at United Drug Company are as follows:

- (1) .0057 percentage of rent expense to the sales volume at wholesale prices.
- (2) .021 percentage of unabsorbed burden for one month.
- (3) .0346 percentage of advertising expense to the net sales volume figure.
- (4) .4487 percentage of a quota filled to date.
- (5) .4169 percentage of cost of drugs and chemicals to the net sales volume.
- (6) .4891 percentage of regular sales to net sales volume. (excluding one-cent sales and monthly specials)

There are one hundred and twenty-seven members connected with the accounting department, all of whom employ decisions in the form of percentage figures. Such calculations apply to four places and disclose relations between costs, distribution of overhead, and other expenses to the net sales figure which is used as the base for all percentage findings.

The twenty-two employees in the credit department are not concerned with decisions, except the credit manager, who makes a reading knowledge to interpret the four place percentage findings which are included on reports received from the accounting department.

The other clerical employees, including stenographers, mail department clerks, time keepers, and sundry clerks need no knowledge whatever of decisions in order to perform their daily duties.

Illustrations of typical decisions used at United Drug

Company are as follows:

- (1) .0087 percentage of rent expense to the sales value of wholesale prices.
- (2) .031 percentage of unabsorbed burden for one month.
- (3) .0345 percentage of advertising expense to the net sales volume figure.
- (4) .4487 percentage of a quote filled to date.
- (5) .5159 percentage of cost of drugs and chemicals to the net sales volume.
- (6) .4991 percentage of regular sales to net sales volume, excluding one-cent sales and monthly specials.

- (7) .327 percentage of alcoholic content in a neutralizing cordial preparation.
- (8) 6.73 pints of grain alcohol.

The data thus presented is condensed briefly in Table XII on the succeeding page.

No. Available		No. Missing		No. Total	
No. Available		No. Missing		No. Total	
Personnel	7			7	
Working & Sighted	101		1	102	
Manufacturing	700		2	702	
Material & Personnel			24	24	
Units, Substances & Auxiliary	70		1	71	
Overseeing & Reliability	10	1		11	
Calling:					
a) Field Men	101			101	
b) Office Men			24	24	
Office:					
a) Accounting & Statistical			127	127	
b) Credit, Order Writing & Billing	41	1		42	
c) Other	101			101	
Total	1400	2	102	1502	

(7) 4.37 Percentage of alcohol content in a neutral-
ising solution preparation.

(8) 4.78 Ratio of grain alcohol.

The data thus presented is condensed briefly in Table III

on the succeeding page.

Table III is partially self-explanatory. Of the fifteen hundred persons employed at United Drug Company one hundred and eighty-four employees in the receiving and storage department, seven hundred and fifty-eight employees engaged in manufacturing

XII. Table Showing the Personnel and Amount of Decimal Knowledge Needed at United Drug, Incorporated.

Split-up of personnel	No. needing no knowledge of decimals	No. needing a reading knowledge	No. who compute decimals	Sample decimal	Totals
Purchasing		7		.4086	7
Receiving & Storage	184		1	.0057	185
Manufacturing	758		2	.021	760
Analytical & Technical			34	.673	34
Power, Maint- enance & Auxiliary	79		1	.0129	80
Advertising & Publicity	19	1		.0346	20
Selling: (a) Field Men (b) Office Men	101		38	.4487	101 38
Office: (a) Accounting & Statistical			127	.4891	127
(b) Credit, Or- der Writing & Billing	21	1		.2362	22
(c) Other Clerical	126				126
Totals	1288	9	203		1500

XII. Table Showing the Personnel and Amount of Dental Income
Ledged Based at United Fruit, Incorporated.

Totals	1938	2	103	1500	Totals		
					Office	Other	193
(a) Other	135	1		135	135		135
(b) Credit, Or- der Writing & Billing	21	1		22	22		22
(c) Accounting & Statistical			127	127	127		127
(d) Office Men	101		38	139	139		139
(e) Field Men							
(f) Field Men							
(g) Field Men							
(h) Field Men							
(i) Field Men							
(j) Field Men							
(k) Field Men							
(l) Field Men							
(m) Field Men							
(n) Field Men							
(o) Field Men							
(p) Field Men							
(q) Field Men							
(r) Field Men							
(s) Field Men							
(t) Field Men							
(u) Field Men							
(v) Field Men							
(w) Field Men							
(x) Field Men							
(y) Field Men							
(z) Field Men							

Table XII is partially self-explanatory. Of the fifteen hundred persons employed at United Drug Company one hundred and eighty-four employees in the receiving and storage department, seven hundred and fifty-eight employees engaged in manufacturing, seventy-nine maintenance men, nineteen advertising and publicity workers, one hundred and one field salesmen, twenty-one credit clerks, and one hundred and twenty-six clerical workers need to possess no knowledge of decimals in order to carry out their daily duties. This number represents 85.78% of the total number of employees. There are seven purchasing agents, one advertising manager, and one credit manager, or .60% of the entire personnel who need a reading knowledge to extend not beyond four places. One warehouse manager, two manufacturing executives, thirty-four analysts, one construction engineer, thirty-eight office salesmen, and one hundred and twenty-seven accounting and statistical workers must compute decimals in their daily work. However, no difficulties are encountered because none of these employees calculate decimals in any degree or amount in excess of four places. And the most usual reason for the use of decimals, as indicated by this study, is to disclose percentage relations for the purposes of affording comparisons between periods in factory costs and merchandising operations.

These groupings are shown in Chart VI.

These groupings are shown in Chart VI.

periods in factory costs and merchandising operations.

age relations for the purpose of affording comparisons between of decimals, as indicated by this study, is to disclose percent- excess of four places. And the most usual reason for the use these employees calculate decimals in any degree or amount in work. However, no difficulties are encountered because none of and statistical workers must compute decimals in their daily office salesmen, and one hundred and twenty-seven accounting thirty-four analysts, one construction engineer, thirty-eight places. One warehouse manager, two manufacturing executives, personnel who need a reading knowledge to extend not beyond four ing manager, and one credit manager, or .60% of the entire per-

of employees. There are seven purchasing agents, one advertise- billy duties. This number represents 86.78% of the total number possess no knowledge of decimals in order to carry out their clerks, and one hundred and twenty-six clerical workers need to workers, one hundred and one field salesmen, twenty-one credit seventy-nine maintenance men, nineteen advertising and publicity seven hundred and fifty-eight employees engaged in manufacturing, eighty-four employees in the receiving and storage department, hundred persons employed at United Drug Company one hundred and Table XII is partially self-explanatory. Of the fifteen

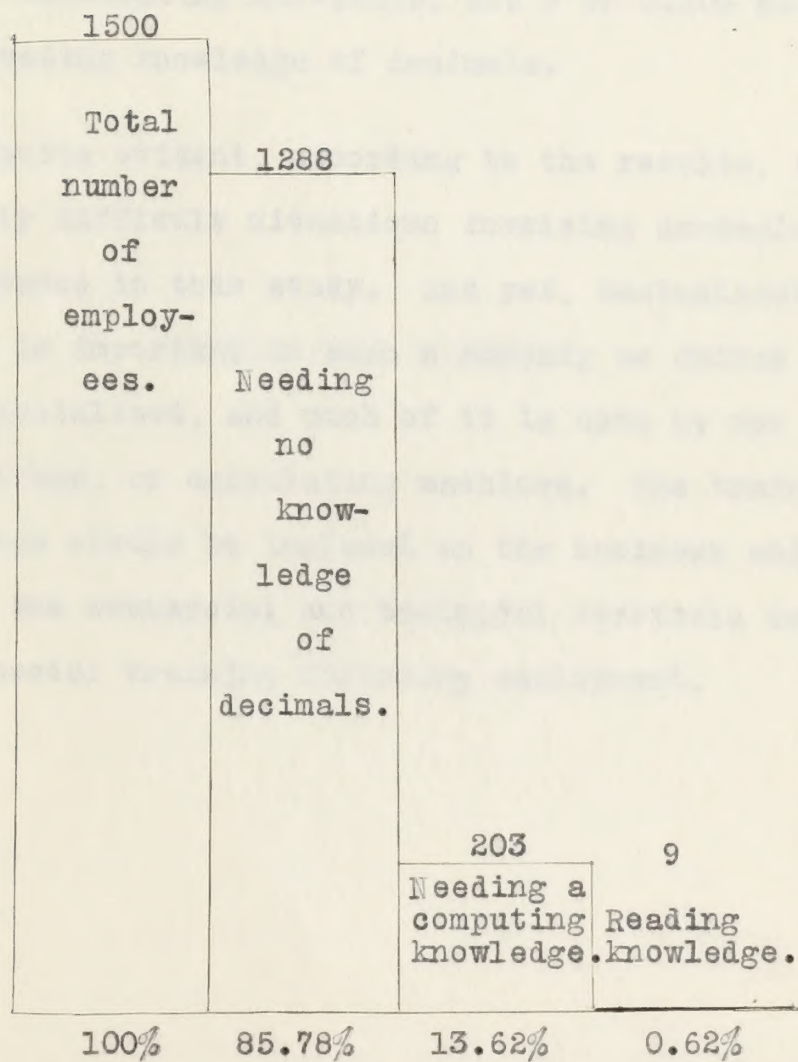


Chart VI. Showing the Number of Employees and Extent of Decimal Knowledge in Use at United Drug, Incorporated.

Chart VI. Showing the Number of Employees and extent of Decimal Knowledge in Use at United Drug, Incorporated.

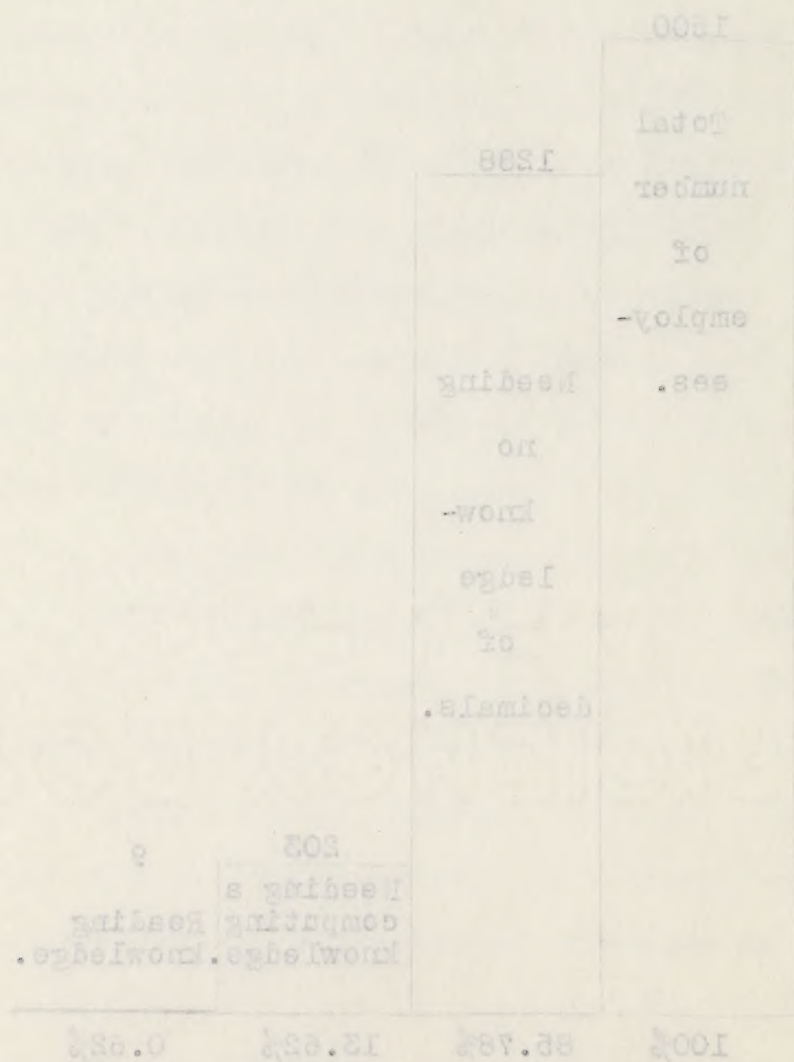


Chart VI is to be interpreted as follows:

Of the 1500 persons employed at United Drug Incorporated, 1288 or 85.78% of the total number need no knowledge whatever of decimals; 203 employees or 13.62% of the total must have a calculating knowledge; and 9 or 0.60% need to possess a reading knowledge of decimals.

It is quite evident, according to the results, that no exceptionally difficult situations involving decimals have been encountered in this study. And yet, decimalization of percentages is important in such a company as United Drug. It is highly specialized, and much of it is done by use of slide rule, logarithms, or calculating machines. The training for such knowledge should be included in the business and scientific programs of the commercial and technical curricula or in the intensive special training following employment.

Chart VI is to be interpreted as follows:

Of the 1500 persons employed at United Drug Incorporated, 1288 or 85.7% of the total number need no knowledge whatever of decimals; 203 employees or 13.5% of the total must have a calculating knowledge; and 9 or 0.6% need to possess a reading knowledge of decimals.

It is quite evident, according to the results, that no exceptionally difficult situations involving decimals have been encountered in this study. But yet, decimalization of percentages is important in such a company as United Drug. It is highly specialized, and much of it is done by use of slide rule, logarithms, or calculating machines. The training for such knowledge should be included in the business and scientific programs of the commercial and technical curricula or in the intensive special training following employment.

7. WRITING WITH COMPARISONS

Whiting Milk Companies operate throughout New England, particularly in Massachusetts and Rhode Island. Four subsidiaries come under the jurisdiction of this parent company, namely, Somerset Farms Creamery Company, Bushway Ice Cream Company, Skowhegan Jersey Creamery Company, and Solon Creamery Company. The products distributed and sold by Whiting Milk Companies are milk, cream, buttermilk, skim milk, butter, and ice cream.

The author conducted his research at the Charlestown branch, located at 590 Rutherford Avenue. This is the largest branch of the entire company; it is here that the main office is located. Messrs. John J. Riordan and William C. Gleason, comptroller and assistant comptroller, respectively, interviewed the writer and were of some assistance, although, due to company policy they could not disclose genuine figures. However, they did express the extent of decimal usages, but the figures received by the writer are at best, only approximations. Notwithstanding, the data collected parallels existing conditions, and although the decimals shown in this study are not true because of changed figures, still, the number of places in each decimal calculation has not been changed. On such a basis, then, the data is thus presented:

There are nine hundred and thirty persons employed at the Charlestown branch of Whiting Milk Companies, segregated into eight departments. In the plant processing section there are

Whiting Milk Companies operate throughout New England, particularly in Massachusetts and Rhode Island. Four subsidiaries come under the jurisdiction of this parent company, namely, Somerset Farms Creamery Company, Freshway Ice Cream Company, Shawmut Jersey Creamery Company, and Boston Creamery Company. The products distributed and sold by Whiting Milk Companies are milk, cream, buttermilk, skim milk, butter, and ice cream.

The author contacted his research at the Charlestown branch, located at 530 Rutherford Avenue. This is the largest branch of the entire company; it is here that the main office is located. Messrs. John J. Rishman and William C. Gleason, comptroller and assistant comptroller, respectively, interviewed the writer and were of some assistance, although, due to company policy they could not disclose genuine figures. However, they did express the extent of decimal wastes, but the figures received by the writer are at best, only approximations. Notwithstanding, the data collected parallels existing conditions, and although the decimals shown in this study are not true because of changed figures, still, the number of places in each decimal calculation has not been changed. On each a basis then, the data is thus presented:

There are nine hundred and thirty persons employed at the Charlestown branch of Whiting Milk Companies, segregated into eight departments. In the plant processing section there are

employed one hundred and thirty persons. Of this number, only the plant manager needs to calculate decimals in constructing formulae for milk and cream content, and for butterfat ratios. Such computations extend to six places in many instances. The other employees of this department are engaged in receiving and pasteurizing milk; bottling, capping and storing milk and cream; washing milk containers; and shipping milk products.

In the sales department are five hundred employees whose duties consist of soliciting orders and distributing the company's products to wholesale and retail customers. Sixty persons calculate decimals for the purpose of determining bonuses on a commission basis. The rate of commission is 4% and from this percentage base the bonuses are ascertained.

The laboratory contains ten persons who use decimals in determining butterfat content of all milk and cream products. In addition, milk is examined and tasted for flavor, purity, freshness, and bacteria content. Calculations range from three to six places in all these analyses.

Seventy persons are employed at the plant garage of which number four compute decimals in forms of percentages to disclose relationships between mileage ratio costs. In other words, the mileage and fuel consumption of each truck is compared, and if the percentage finding is high the cause is investigated. Causes for high overhead in this respect would be due to a faulty motor, poor fuel distribution, location of route (city or

employed one hundred and thirty persons. Of this number, only the plant manager needs to calculate decimals in conducting formulas for milk and cream content, and for butterfat ratios. Such computations extend to six places in many instances. The other employees of this department are engaged in receiving and pasteurizing milk; bottling, weighing and storing milk and cream; washing milk containers; and shipping milk products.

In the sales department are five hundred employees whose duties consist of soliciting orders and distributing the company's products to wholesale and retail customers. Sixty per cent of these decimals for the purpose of determining bonuses on a commission basis. The rate of commission is 4% and from this percentage base the bonuses are ascertained.

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Causes for high overhead in this respect would be due to a faulty motor, poor fuel distribution, location of route (city or

country), etc. Every effort is made to hold such expenses to a minimum.

The general office and route accounting department is composed of one hundred persons of which nineteen calculate decimals to four places, determining the amounts of milk producers' checks, and figuring percentages of costs and expenses. Six place decimals are employed in computing material costs and processing expenditures on a unit basis. For example (an approximation):

COSTS BASED ON ONE QUART UNITS

Material cost	\$.101683
Processing	.010924
Delivery	.057512
Overhead	<u>.012831</u>
Total Cost	.182950
Selling price	<u>.18</u>
Net Loss	\$.002950

The remaining number of employees, consisting of city receiving workers, stable employees, and maintenance men are not concerned in any way with decimals; they need no knowledge of them in their work.

The following figures represent only approximations at best. Although they are erroneous, yet they do exhibit the actual lengths of the decimals.

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The general office and route accounting department is composed of one hundred persons of which nineteen calculate deals to four places, determining the amounts of milk producers' checks, and figuring percentages of costs and expenses. Six place decimals are employed in computing material costs and processing expenditures on a unit basis. For example (an approximation):

COSTS BASED ON ONE QUART UNITS

Material cost	\$.10168
Processing	.010024
Delivery	.037512
Overhead	<u>.012231</u>
Total cost	.161457
Selling price	<u>.18</u>
Net loss	\$.002543

The remaining number of employees, consisting of city receiving workers, stable employees, and maintenance men are not concerned in any way with decimals; they need no knowledge of them in their work.

The following figures represent only approximations at best. Although they are erroneous, yet they do exhibit the actual functions of the decimals.

Net Sales		100.00%
Material Costs	42.00%	
City Receiving	3.09%	
Processing	<u>10.13%</u>	<u>55.22%</u>
Gross Manufacturing Profit		44.78%
Delivery		<u>30.08%</u>
Gross Profit		14.70%
Operating Expenses:		
General and Administrative	5.86%	
Selling	<u>7.21%</u>	
Total Operating		<u>13.07%</u>
Net Profit		1.63%

Cream is converted to butterfat by applying the butterfat content per quart to each grade of cream, such as:

18% cream	times	.38054
25% cream	times	.52425
40% cream	times	.82800

A summary of this approximated data is shown in condensed form on the next page.

100.00	Net Sales
93.00	Material Costs
8.00	City Receiving
10.13	Processing
55.83	Gross Manufacturing Profit
44.75	
30.00	Delivery
14.75	Gross Profit
	Operating Expenses:
	General and Administrative
5.50	
7.25	Selling
13.07	Total Operating
1.68	Net Profit

Cream is converted to butterfat by applying the butterfat

content per quart to each grade of cream, such as:

18% cream	times .38084
20% cream	times .38435
40% cream	times .38900

A summary of this approximated data is shown in con-

tinued form on the next page.

Table XIII is partially self-explanatory. Of the nine hundred and thirty persons employed at the Whiting Milk Companies, seventy-five in the general office, four hundred and thirty in the sales department, fifty stable employees, twenty city receivers, one hundred and twenty-nine processors, fifty

XIII. Table Showing the Personnel and Amount of Decimal Knowledge Needed at the Whiting Milk Companies.

Split-up of Personnel	No. needing no knowledge of decimals	No. needing a reading knowledge	No. who compute decimals	Sample decimal	Totals
General Office and Route Accounting	75	6	19	.1013	100
Sales	440		60	.04	500
Stable	50				50
City Receiving	20				20
Plant Processing	129		1	.101683	
Maintenance	50				50
Laboratories			10	.38054	10
Truck Service and Garage	66		4	.3008	70
Totals	830	6	94		930

Table showing the Personnel and Amount of Personal Allowance Needed at the Whiting Mill Corporation.

Personnel of	No. needed of	No. needed of	No. needed of	No. needed of	Personal Allowance
General Office and House Accounting	75	5	19	1018	100
Sales	440		80	94	800
Stables	50				50
City Receiving	30				20
Plant Procurement	125		1	10188	
Maintenance	30				20
Transportation			10	33024	10
Truck Service and Garage	50		4	3008	70
Totals	830	5	94		930

Table XIII is partially self-explanatory. Of the nine hundred and thirty persons employed at the Whiting Milk Companies, seventy-five in the general office, four hundred and forty in the sales department, fifty stable employees, twenty city receivers, one hundred and twenty-nine processors, fifty maintenance men, and sixty-six mechanics need no knowledge of decimals at all. This group represents 89.24%. Six executives, representing 0.64% of the entire personnel need to possess a reading knowledge. Nineteen office employees, sixty salesmen, one plant manager, ten chemists, and four service men are required to compute decimals in their daily work.

These groupings are shown in Chart VII.



Chart VII. Showing the number of employees and extent of decimal knowledge on part of the Whiting Milk Companies.

Table XII is partially self-explanatory. Of the nine hundred and thirty persons employed at the Whiting Milk Company, seventy-five in the general office, four hundred and forty in the sales department, fifty stable employees, twenty city receivers, one hundred and twenty-nine processors, fifty maintenance men, and sixty-six mechanics need no knowledge of German at all. This group represents 89.34%. Six executives representing 0.64% of the entire personnel need to possess a reading knowledge. Nineteen office employees, sixty salesmen, one plant manager, ten chemists, and four service men are required to converse fluently in their daily work.

These groupings are shown in Chart VII.

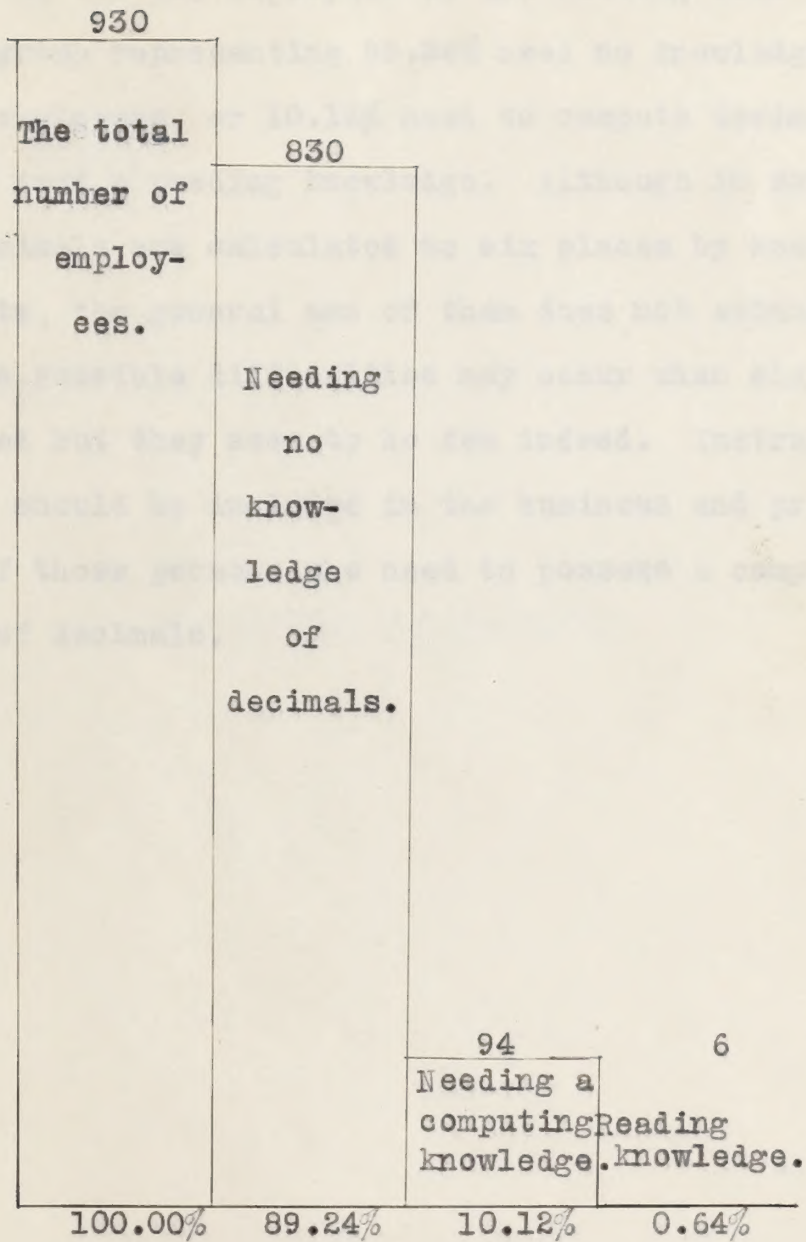


Chart VII. Showing the Number of Employees and Extent of Decimal Knowledge in Use at the Whiting Milk Companies.

Chart VII. Showing the Number of Employees and Extent of
 Technical Knowledge in Use at the Whiting Milk
 Companies.

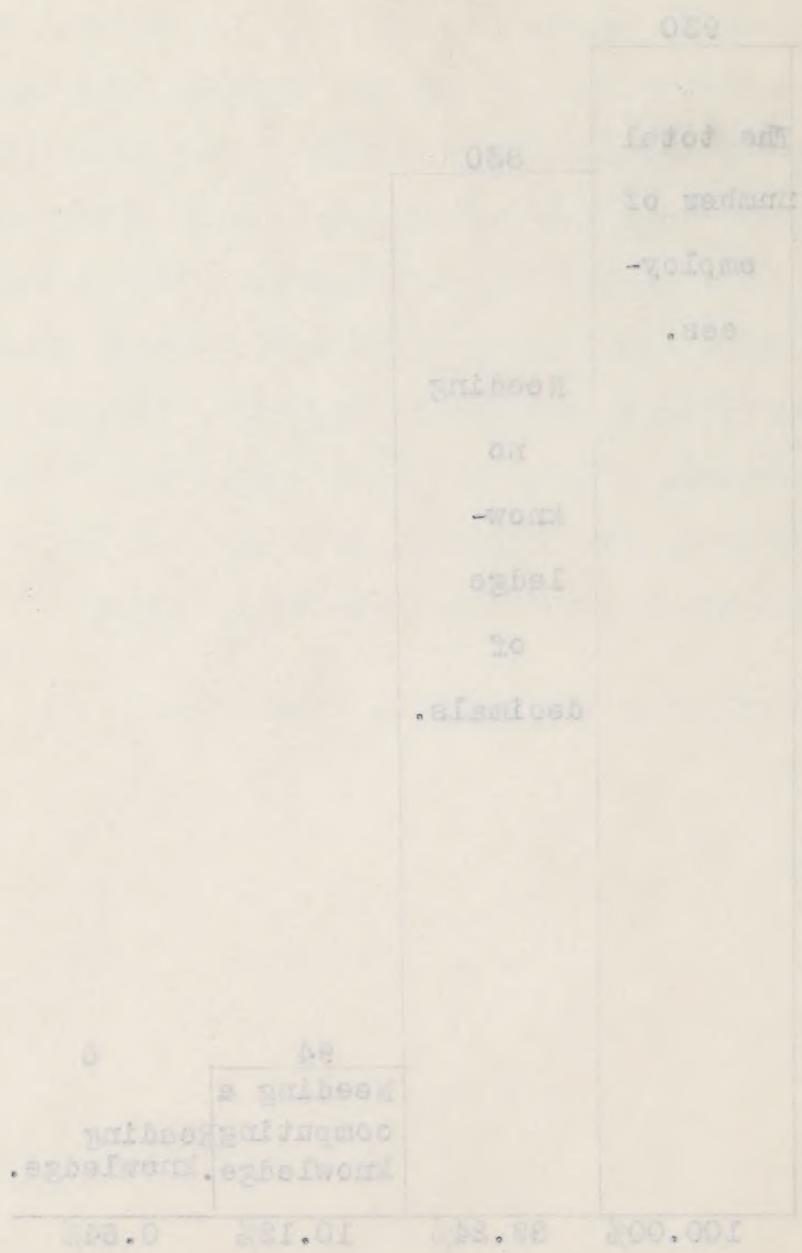


Chart VII is interpreted as follows:

Of the 930 employees at the Whiting Milk Companies, 830, or a group representing 89.24% need no knowledge of decimals; 94 employees, or 10.12% need to compute decimals; and 6, or 0.64% need a reading knowledge. Although in some instances decimals are calculated to six places by accountants and chemists, the general use of them does not extend beyond four places. Possible difficulties may occur when six places are computed but they seem to be few indeed. Instruction for such usage should be included in the business and professional training of those persons who need to possess a computational knowledge of decimals.

Chart VII is interpreted as follows:

Of the 230 employees at the Whiting Milk Company, 230, or a group representing 23.2%, need no knowledge of decimals; 94 employees, or 10.1%, need to compute decimals; and 6, or 0.6%, need a reading knowledge. Although in some instances decimals are calculated to six places by accountants and chemists, the general use of them does not extend beyond four places. Possible difficulties may occur when six places are computed but they seem to be few indeed. Instruction for such usage should be included in the business and professional training of those persons who need to possess a computational knowledge of decimals.

IV. Table Showing the Aggregated Personnel and Amount of Medical Knowledge Secured in the Above Investigations.

(1)	(2)	(3)	(4)	(5)
Name of Person Investigated	No. having no knowledge of details	No. having a working knowledge of details	No. who complete details	Total
(1) Chandler			505	505
IV. <u>STATISTICAL COMPILATIONS</u>				
(1) Mount Hope Hospital	20		52	72
(2) Ohio Cigar Company	105	21	45	171
(3) Manufacturers Financial Service Corporation	41	14	35	90
(4) Barringer and the Virginia Company	79	2	15	96
(5) United Drug Corporation	100	3	42	145
(6) Walling Bank Corporation	400	5	56	461
Total	645	25	705	1375
Percentage of Totals	46.9	1.8	51.3	100.0

STATISTICAL CONDITIONS

XIV. Table Showing the Aggregated Personnel and Amount of Decimal Knowledge Needed in the Seven Investigations.

(1) Name of Concern Investigated	(2) No. Needing no knowledge of decimals	(3) No. needing a reading knowledge	(4) No. who compute decimals	(5) Totals
(1) Chandler & Co.	172	30	298	500
(2) Forest Hills Hospital	28		46	74
(3) Otis Elevator Company	186	21	45	252
(4) Devonshire Financial Service Corporation	81	14	14	109
(5) Burroughs Adding Machine Company	70	2	33	105
(6) United Drug Incorporated	1288	9	203	1500
(7) Whiting Milk Companies	830	6	94	930
Totals	2655	82	733	3470
Percentages of Totals	76.51	02.36	21.13	100.00

XIV. Table showing the Integrated Personnel and Amount of Special Knowledge Needed in the Seven Investigations.

(1) Name of Concern Investigated	(2) No. having no knowledge of estimate	(3) No. having a working knowledge	(4) No. who compute estimate	(5) Totals
(1) Chandler & Co.	178	30	208	388
(2) Forest Mills Hospital	28		48	76
(3) Cils Elevator Company	188	21	48	257
(4) Devonshire Film-Label Service Corporation	81	14	14	109
(5) Burroughs Adding Machine Company	70	8	38	108
(6) United Press Incorporated	1818	9	201	1828
(7) Witten Mill Companies	880	8	94	982
Totals	2236	82	733	3051
Percentages of Totals	74.51	2.68	24.13	100.00

Table XIV is partially self-explanatory. Of the 3470 employees under investigation which represents the aggregate total of seven business concerns, 2655, or 76.51% need no knowledge of decimals at all in their work; 82 employees, a group representing 2.36% of the total need a reading knowledge; and 733 or 21.13% must know how to figure decimals in some form. The range of calculations observed in all these investigations extended from one place decimals at one extreme, to eight place decimals at the other. Both of these extremes were found in one unit under investigation, namely, the Forest Hills Hospital. In some instances, six place decimals were computed, particularly at Whiting Milk Companies. Five place calculations were observed at the Otis Elevator Company. Every concern under investigation employed four, three and two place decimals with three place figures being found to be the most numerous for calculating purposes.

In the Dalrymple study heretofore mentioned on page 9, results were as follows: no decimal knowledge, 80%; reading knowledge, 11%; computative knowledge, 9%. Such findings vary somewhat from those determined by the author. Not to detract from Miss Dalrymple's study, however, it is true, nevertheless, that she carried on her research in only two concerns, both of which were the factory type of industry. The author's study, on the other hand, included seven varied and distinct types of business, considered by him to represent an adequate sampling of the entire business field. Therefore, the discrepancy

Table XIV is a typical self-explanatory. Of the 3470 employees under investigation which represents the aggregate total of seven business concerns; 2255, or 65.0% need no knowledge of decimals at all in their work; 82 employees, a group representing 2.3% of the total need a working knowledge; and 1113 or 32.7% need know how to figure decimals in some form. The range of calculations observed in all these investigations extended from one place decimal at one extreme, to eight place decimals at the other. Both of these extremes were found in one unit under investigation, namely, the Forest Hills Hospital. In some instances, six place decimals were computed, particularly at Building Hill Company. Five place calculations were observed at the Otto Elevator Company. Every concern under investigation employed four, three and two place decimals with three place figures being found to be the most numerous for calculating purposes.

In the following study heretofore mentioned on page 8, results were as follows: no decimal knowledge, 80%; reading knowledge, 15%; computational knowledge, 5%. Such findings vary somewhat from those determined by the author. Not so different from Miss Delany's study, however, it is true, nevertheless, that she carried on her research in only two concerns, both of which were the factory type of industry. The author's study, on the other hand, included seven varied and distinct types of business, considered by him to represent an adequate sampling of the entire business field. Therefore, the differences

existing between the two studies is to be expected.

The statistics as compiled by Miss Dalrymple have been incorporated with the author's own findings in Table XV which is shown on the next page.

Table XV. Showing the Aggregate Percentages and Amount of Animal Knowledge Secured in the Dalrymple Study and the Author's Study Combined.

(1) Distribution according to:	(2) No. speaking no knowledge of animals	(3) No. speaking a reading knowledge	(4) No. who complete	(5) Totals
(1) Miss Dalrymple (2 unit studies)	130	100	110	340
(2) The Author (3 unit studies)	240	82	132	454
Totals	370	182	242	794
Percentages of Totals	46.6%	22.9%	30.5%	100.0%

existing between the two studies is to be expected.

The statistics so compiled by Miss Karpovich have been incorporated with the author's own findings in Table IV which is shown on the next page.

Table XV is partially self-explanatory. The figures combined into both studies show an aggregate total of 4670 employees distributed among 224 units of knowledge. Of this collective number, 3610 persons, representing 77.30 % have no knowledge whatever to engage in decimal processing; 212 employees, or 4.54 % have a reading knowledge; and 848, or 18.16 % have a computable knowledge of decimals.

XV. Table Showing the Aggregate Personnel and Amount of Decimal Knowledge Needed in the Dalrymple Study and the Author's Study Combined.

(1) Distribution according to:	(2) No. needing no knowledge of decimals	(3) No. needing a reading knowledge	(4) No. (who compute decimals	(5) Totals
(1) Miss Dalrymple (2 unit studies)	955	130	115	1200
(2) The author (7 unit studies)	2655	82	733	3470
Totals	3610	212	848	4670
Percentages of totals	77.30	4.54	18.16	100.00

IV. Table Showing the Aggregate Personnel and Amount of Decimal Knowledge Needed in the Dairymale Study and the Author's Study Combined.

(1) Distribution of decimal No. needing no knowledge		(2) No. needing a reading knowledge	(3) No. (who compute decimals	(4) Totals
(1) Miss Dairymale (3 unit studies)		130	115	1200
(2) The author (7 unit studies)		82	733	3470
Totals		212	848	4670
Percentages of totals		4.84	18.18	100.00

Table XV is partially self-explanatory. The figures combined into both studies show an aggregate total of 4670 employees distributed among nine units of business. Of this collective number, 3610 persons, representing 77.30 %, have no occasions whatever to engage in decimal processes; 212 employees, or 4.54% need a reading knowledge; and 848, or 18.16% must have a computative knowledge of decimals.

One fact of significance noted was that more than 75% of the people engaged in the highly specialized businesses, forming a basis of this study and one previous study, need no knowledge of decimals whatever. And, yet, the country over, decimals are considered to be a drill topic in arithmetic for all grade children. Apparently, school men need to seriously consider the reduction of the drill load in decimals.

Turning now to the group using decimals. Less than one-fourth of all persons employed in these highly specialized industries really have occasion for such usage. The figuring in decimals, done by these specialists, is largely that of decimalization of percentages, mostly three places, but also two, four, five six, and even eight places. It is a simple process in which proficiency is easily attained on the job. A few persons, (approximately 2.5%) need to have a highly technical or expert knowledge.

Table IV is partially self-explanatory. The figures com-
bined into both studies show an aggregate total of 4870 em-
ployees distributed among nine units of business. Of this
collective number, 2510 persons, representing 51.5%, have no
occasions whatever to engage in decimal processes; 515 employ-
ees, or 10.6%, need a working knowledge; and 645, or 13.1%, must
have a comprehensive knowledge of decimals.

One fact of significance noted was that more than 70% of
the people engaged in the highly specialized businesses, form-
ing a basis of this study and one previous study, need no know-
ledge of decimals whatever. And, yet, the country over, dec-
imals are considered to be a drill topic in arithmetic for all
grade children. Apparently, school men need to seriously con-
sider the reduction of the drill load in decimals.

Turning now to the group using decimals. Less than one-
fourth of all persons employed in these highly specialized
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in decimals, done by these specialists, is largely that of
decimalization of percentages, mostly three places, but also
two, four, five six, and even eight places. It is a simple
process in which proficiency is easily attained on the job. A
few persons, (approximately 2.5%) need to have a slightly tech-
nical or expert knowledge.

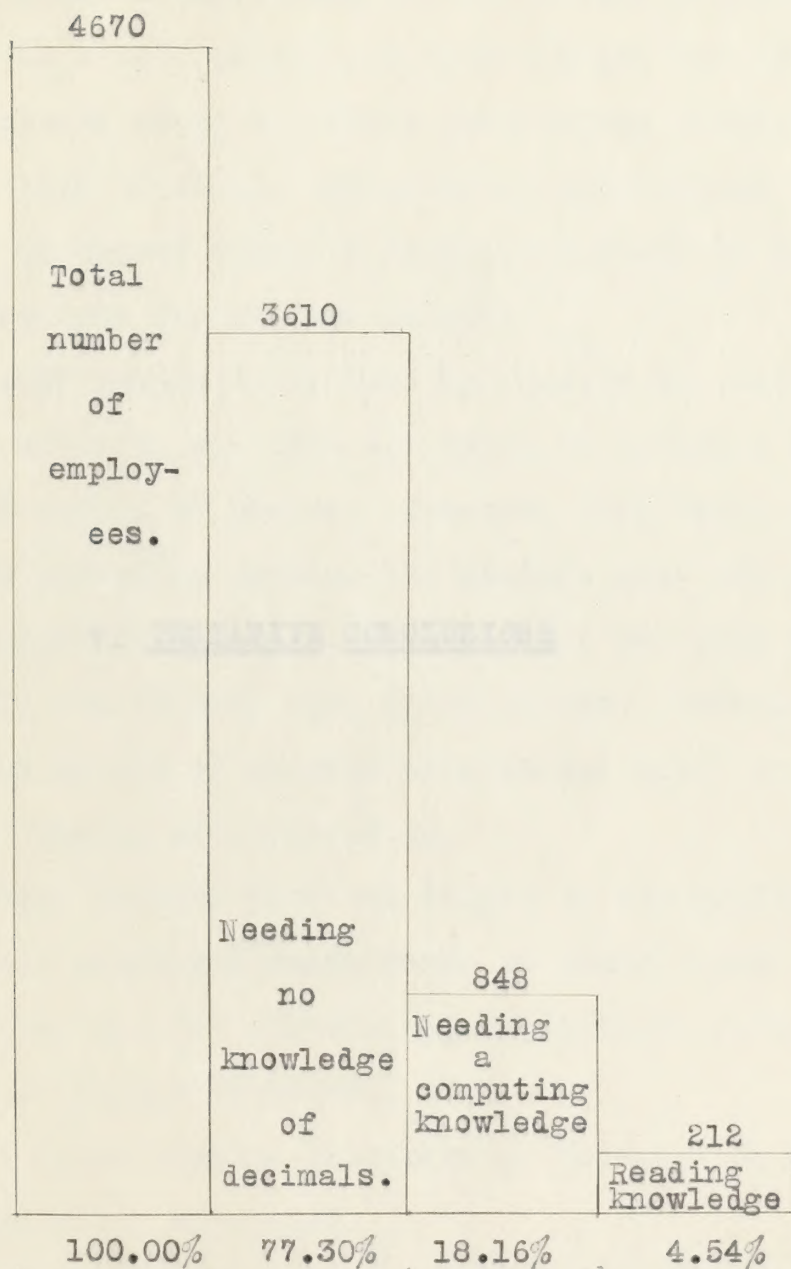
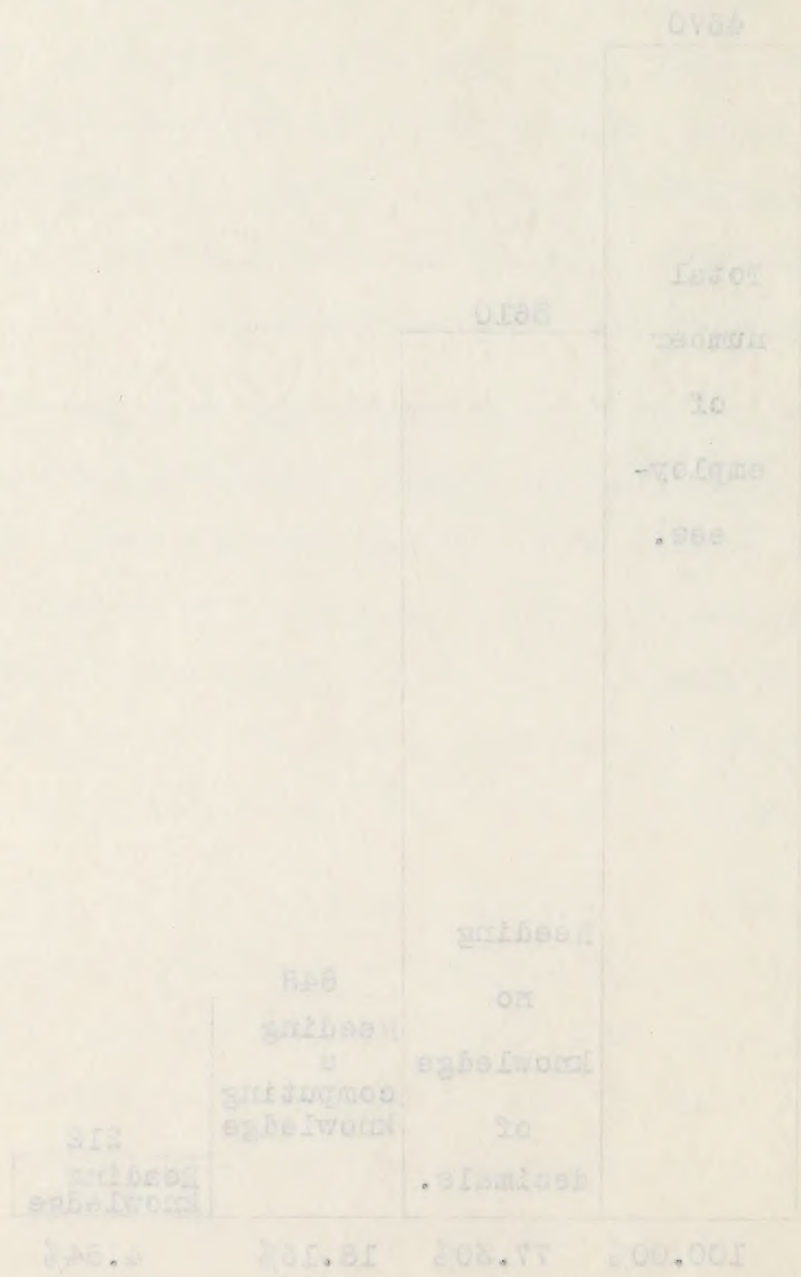


Chart VIII. Showing the Number of Employees and Extent of Decimal Knowledge in Miss Dalrymple's Study and the Author's Study.

Chart VII. Showing the number of employees and extent of
 General knowledge in Miss Dalglish's study
 and the latter's study.



V. TENTATIVE CONCLUSIONS

(1) The most practical values of decimals are involved with three place calculations; a little less practical use is contained, possibly, in one and four places; and decimals beyond four places occur in highly specialized situations. Obviously, then, with the exception of specialized, highly technical, or expert cases it is not necessary to extend decimal computations beyond four places.

(2) Some people think that arithmetic is exceptionally fine drill material and that all types of decimals should be used to any number of places. However, this tends to be a meaningless procedure because the student does not really know why he is figuring decimals. He only can perceive that the teacher told him to make such calculations. Consequently, the work becomes merely an unreasonable mental drill procedure that lacks meaning and motivation.

(3) Many decimal problems taught in the grades do not relate to the practical cases found in common life. Since these problems are not encountered in lifelike situations, they should not be taught in school.

(4) A broad reading knowledge of decimals is more necessary than a computative knowledge.

(5) Results show very definitely that those persons who are required to have a computative knowledge of decimals are decidedly in the minority when all tangible cases are considered. The logical inference follows, therefore, that the great

(1) The most practical values of decimals are involved with three place calculations; a little less practical are contained, possibly, in one and two places; and decimals beyond four places occur in highly specialized situations. Obviously, then, with the exception of specialized, highly technical, or expert cases it is not necessary to extend decimal computations beyond four places.

(2) Some people think that arithmetic is exceptionally fine drill material and that all types of decimals should be used to any number of places. However, this tends to be a meaningless procedure because the student does not really know why he is figuring decimals. He only can perceive that the teacher told him to make such calculations. Consequently, the work becomes merely an unresponsible mental drill procedure that lacks meaning and motivation.

(3) Many decimal problems taught in the grades do not relate to the practical cases found in common life. Since these problems are not encountered in lifelike situations, they should not be taught in school.

(4) A broad reading knowledge of decimals is more necessary than a computational knowledge.

(5) Results show very definitely that those persons who are required to have a computational knowledge of decimals are decidedly in the minority when all tangible cases are considered. The logical inference follows, therefore, that the great

majority of persons need to possess only a reading knowledge at best. Computational usage is highly specialized, and, no doubt, should be left largely to training on the job.

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